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COMMUNICATION TECHNIQUES DEPARTMENT



Texscan



COMMUNICATION TECHNIQUES DEPARTMENT

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Serial AG501

AF 06-81706

OPERATING AND INSTRUCTION MANUAL

SWEEP GENERATOR

MODEL WB-713 SERIES

TEXSCAN CORPORATION

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Indianapolis, Indiana 46219

317-357-3781

Part # For
P101 } Plug # 4/30/77
P102 } 244-039 204 enb.

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SECTION I
SPECIFICATIONS

	<u>WB-713 BAND 1</u>	<u>WB-713 BAND 2</u>
1.1 FREQUENCY RANGE	1 - 500 MHz.	450 - 960 MHz.
1.2 POWER OUTPUT	+10 dBm (.7V).	+10 dBm (.7V).
1.3 STABILITY	Residual FM 10 kHz. Drift 100 kHz/15 minutes.	Residual FM 10 kHz. Drift 100 kHz/15 minutes.
1.4 FLATNESS	<u>+0.25 dB.</u>	<u>+0.25 dB.</u>
1.5 DISTORTION	-35 dB below output.	-30 dB below output.
1.6 IMPEDANCE	50 ohm standard. 75 ohm optional.	50 ohm standard. 75 ohm optional.
1.7 SWEEP WIDTH	.1 - 500 MHz.	.1 - 510 MHz.
1.8 LINEARITY	2%.	2%.
1.9 BLANKING	RF or video blanking is internally selectable.	RF or video blanking is internally selectable.
1.10 DIAL CALIBRATION	1% full scale.	1% full scale.
1.11 VERNIER FREQUENCY	<u>+2 MHz</u> <u>+5 MHz.</u>	<u>+2 MHz</u> <u>+5 MHz.</u>
1.12 ATTENUATION	0-10 dB vernier standard. 0-70 dB in 10 dB steps optional.	0-10 dB vernier standard. 0-70 dB in 10 dB steps optional.
1.13 MARKERS	Optional - four plug-ins. Optional - 50, 10, & 1 MHz.	Optional - four plug-ins. Optional - 50, 10, & 1 MHz.
1.14 AMPLITUDE PROGRAMMING	Available at rear panel.	Available at rear panel.
1.15 RATE PROGRAMMING	Available at rear panel.	Available at rear panel.
1.16 FREQUENCY PROGRAMMING	Available at rear panel.	Available at rear panel.
1.17 SIZE	9" X 4-3/16" X 12- 5/8" (22.9 X 10.6 X 32.1 cm).	9" X 4-3/16" X 12- 5/8" (22.9 X 10.6 X 32.1 cm).
1.18 POWER REQUIREMENTS	115/230V AC, 50/60 Hz, 50W.	115/230V AC, 50/60 Hz, 50W.

SECTION 2

BLOCK DIAGRAM & CIRCUIT DESCRIPTION

2.1 INTRODUCTION

The WB-713 Series has six power supplies; +24V DC, -24V DC, +15V DC, -15V DC, and two separate +5V supplies.

2.2 +24 VOLTS

The +24 volts supply is derived from bridge rectifier CR1 from one of the secondary windings of T1. R1 is a surge limiting resistor in series with an integrated circuit regulator IC1, a type 7824. The unregulated input of approximately +28 to +36 volts is present at the input of IC1 and +24V DC non-adjustable output is derived from the positive end of C2.

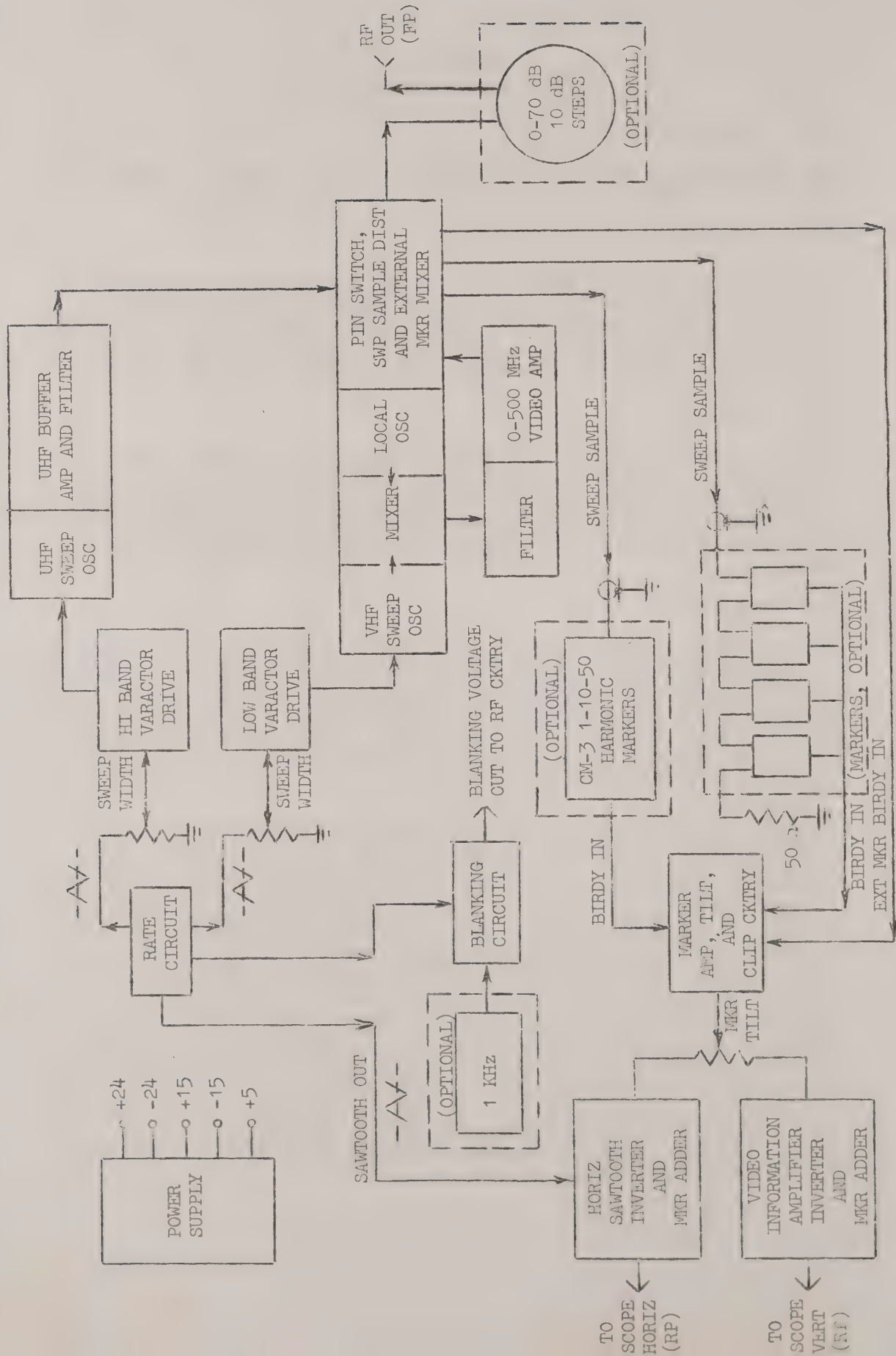
2.3 -24 VOLTS

The -24 volts supply is derived from an additional secondary winding on T1 and rectified by bridge rectifier CR2. There is a surge limiting resistor in series with a 7824 integrated circuit regulator in the ground return leg. This regulator operates by raising the positive return of the bridge rectifier above ground by an amount such that the output is maintained at -24 volts.

2.4 +15 VOLTS

The regulated +24 volts is fed through R2 to the collector of a series regulator transistor Q3 and to Pin 7 of IC2. The output of Q3 is fed through a 2.7 ohm current sense resistor R7. During start-up, an unregulated voltage is applied back through R3 and Q1, a 2N3638 used as a reference zener. The reference zener voltage is applied to Pin 3 of IC2, the 15 volt regulator integrated circuit, and an additional sample from R7, the current limit resistor, is coupled to Pin 2 of the 741.

Whenever the voltage set at R2 by the adjustment of R5 exceeds the zener voltage on Pin 3 of the IC, the output of the integrated circuit at Pin 6 tends to go negative. This action tends to limit base current to the series pass transistor, which reduces the output voltage bringing it back to an equilibrium state. In the converse case, when the output voltage at R7, the current limit resistor, goes below the equilibrium voltage, the output of the integrated circuit regulator tends to go positive delivering more base current to the series pass transistor and raising the output voltage to the equilibrium state. Q2 is a current sensing transistor with R7 connected between its base and emitter leads. When the voltage drop across R7 exceeds the base emitter turn-on voltage for Q2, the transistor switches to an on state shunting the output current from the 741K IC regulator to the load. This in effect starves the base of Q3, shutting down the regulator. C5 furnishes a filter for the adjustable voltage divider R5. R8 provides a return ground for the output of the MJE1100 regulator. The positive 15 volt supply is the only adjustable power supply in the WB-713. The adjustment is obtained by varying R5.



2.5 -15 VOLTS

The previously regulated -24 volts supply is coupled to Pin 4 of IC4. The positive power supply for this regulator IC is derived by zenering the positive 15 volts power supply through VR1, a 10 volt zener, simultaneously furnishing one +5 supply, and applying a +5 to Pin 7 of IC4. The IC, therefore, runs between +5 and -24 volts. The regulating action of the -24 volts supply is derived in the following manner.

As the previously regulated positive 15 volts is already available as a fairly stiff source, the positive 15 volts supply is summed through R17 with the output of Q6, the minus 15 volt regulator, with equal summing resistors. Pin 3 is strapped to ground through R16, a 1K ohm resistor. If the sum of the positive 15 volts regulator and the -15 volts regulator is some positive voltage, the output of IC4 tends to swing negative, taking more current from the base of the MJE1090, turning the series regulator on harder, allowing the voltage at the junction of R19 and R21 to go more negative to create the equilibrium condition. If the voltage at Pin 2 goes negative with respect to ground (that is the -15 volts supply is now some value absolutely larger than the -15 volts), the output of Pin 6 of the IC tends to swing positive, which will reduce the -15 volts output. The purpose of C9, a starred value on the schematic, is to prevent possible oscillation of the MJE1090 series regulator transistor.

2.6 +5 VOLTS (A) & (B)

+5 (A) is derived from a 15 volts power supply directly through zener diode VR1 filtered by C12, a 25 microfarad capacitor.

+5 (B) is derived by reducing the regulated +15 volts down to +5 volts via IC5, a 7805 integrated circuit regulator.

All supply voltages are available on the rear panel at J101. See the schematic diagram in the Documentation Section, Section VI.

2.7 MAIN PRINTED CIRCUIT BOARD

The main printed circuit board provides all operational functions of the WB-713. Circuits involved are the rate circuit, varactor drive circuits, blanking circuit, leveling circuit, and band switching circuit. These will be attacked individually.

2.8 RATE CIRCUIT

The rate circuit is the same circuit which has become standard at Texscan Corporation. There are two integrated circuits combined in one chip, an LM1458, the reference number is IC101. The first half of IC101 is connected as a zero crossing detector, that is, Pin 2 is connected to ground. Anytime Pin 3 goes either positive or negative, the output of Pin 1 will follow to the limits of the power supply, as there is nothing to limit this excursion. The result is a squarewave which rides between positive and negative 12 volts. R109 is a feedback resistor which determines the gain of the first half of IC101. The squarewave generated by IC101 is coupled through a voltage divider, R111 and R112, and the rate limit and sweep rate pot to Pin 6,

the second half of IC101. Pin 6 is the inverting input, Pin 5 is the non-inverting input and clamped to ground. As Pin 6 rises above zero, the output of Pin 7 attempts to go negative. It is not allowed to do so immediately because the second half of IC101 is functioning as an integrator; the integral of a squarewave being a triangular wave. This triangular wave is fed back through R108 to the input which is Pin 3 of the first half of IC101. This is the feedback network which causes the circuit to continue to run, that is, to be repetitive. This is the basic operation of the rate circuit. The output triangular wave, which runs between + and -9 volts centered around zero, is coupled to the rear panel J305 scope horizontal connector through two sections of IC301 where markers are added to accomplish marker tilt.

The time constant of the integrator is determined by the RC time constant of R117, R118, and C106 in the line position, and R117, R114, R115, and R116 along with C107 and C108 in the variable rate position. Additional features of the rate circuit on the WB-713 are provisions for either an external trigger signal, a single sweep trigger signal, or a line sync trigger. Each of these functions will be covered independently. The line sync feature is derived by rotating the sweep rate switch on the front panel to line position. A sinusoidal wave is applied to the input of Q102. The line sync waveform AC-wise is very large and its excursion is limited by R101 and CR103. This prevents overdriving the base of Q102. The input signal is clipped causing the output of Q102 to be a squarewave, which is differentiated by the action of C103 and R107. During the time line sync operation is desired, this synchronizing spike is applied to Pin 2 of the zero crossing detector causing the detector to reset at a line rate and begin its cycle again at that point. In order for this operation to take place properly, the rate limit pot R113 must be set such that the time constant generated is reasonably close to a 60 Hz rate. This will be observed by "locking in" of the signal during line rate.

The external trigger single trigger function is generated by depressing switch S103 which removes the line sync pulses and couples the input from the external trigger input on the rear panel J103 into the base of Q102.

During the time that S103 is depressed, the horizontal waveform voltage will be limited by CR102 and VR101 to a value approximately equal to -7.4 volts. The positive excursion will be to about 9 volts. The external trigger input is processed in the same manner as the line sync input and the triggering spike is applied to the input of IC101. It will be necessary to adjust the sweep rate pot to a value approximating the external trigger rate in order to maintain proper time constant to the integrator.

With S103 depressed and no input on J101, depressing S104 will cause a spike to be generated, triggering the rate circuit. The rate circuit will complete its cycle and shut down at a rate determined by the position of the sweep rate pot, and its time constant.

2.9 VARACTOR DRIVE CIRCUIT - LOW BAND

The varactor drive circuitry will be explained as it pertains to the low band. The high band circuit is identical.

The varactor drive output is taken from Pin 6 of IC103 and is between -15 to +5 volts.

Pin 2 of IC103 is the summing point for CF tuning, rate circuit sawtooth, manual sweep, etc. The center frequency tuning R139 changes the DC level at Pin 2 which in turn changes the DC level of the varactor drive sawtooth, thereby, changing the center frequency of the oscillator. R143 determines the amount of change R139 has on center frequency.

R141, the 10K ohm sweep width control (FP) determines the amplitude of the sawtooth applied to Pin 2. R142 limits the maximum amplitude applied.

In addition to the normal internal sweep functions, the WB-713 provides a CW function. Activate R141 to the limit of its rotation and energizing S107 which effectively shorts the input of the varactor drive circuit. The varactor drive will now be DC at a value determined by the summing of the center frequency control and the centering control. Another feature provided is an external drive input. A tuning ramp is applied to the sweep width pot and the varactor drive signal is derived in the same manner from that point. Also available on the rear panel from J102 is an external tuning voltage input. The center frequency pot may be disconnected and the center frequency determining voltage will be derived from an input to Pin 6 on J102. At J101 of the rear panel, there is a connection between Pin 4 and R211 of the leveler circuit. This provides an input for external monitoring. Pin 6 of J101 provides an input for a programmed external level. Pin 2 of J102 connects to R119. This provides the rate circuit ramp as an output to the rear panel. Pin 12 of J101 provides a squarewave at a rep rate equal to that of the rate circuit.

2.10 BLANKING

The purpose of the blanking circuitry is to provide a synchronous on-off voltage to the video amplifier. The output of 1/2 IC101, the squarewave generator is coupled to the input of the marker amplifier and Q202. Q202 is DC coupled to a Darlington pair consisting of a 2N3568 and MJE4922, Q202 and Q204 respectively. The output of Q204 is a squarewave running between zero and +15 volts minus the saturation voltage of the 4922. This voltage is applied to the B+ on the video amplifier shutting down the video amplifier during blank off time. If video blanking is selected, the video amplifier B+ is supplied at all times and the leveler operates in a normal manner. A +12 volt waveform is voltage divided by R358, R359, R361, R362, and R363 to provide a squarewave to the gates of Q351 and Q352. The video signal from the detector is coupled through R360 to the video amplifier inverter and then to the vertical output. When the FETS Q351 and Q352 are energized by the squarewave, it will short to ground across the scope vertical connection and all voltage appearing at J105 is dropped across R356 giving the appearance that the signal is blanked off.

2.11 LEVELER CIRCUITRY

The leveler's purpose is to maintain the output of the WB-713 at some pre-determined value. This is accomplished by halfwave detecting the output of the video amplifier and coupling this detected voltage to Pin 2 of IC201.

The leveling voltage is summed with a DC voltage derived by the level maximum and minimum pots. These voltages are derived by voltage divider potentiometer networks from the +15 volt power supply. The output of Pin 6 of IC201 will then be an inversion of the output of the video amplifier. This signal is applied to the base of Q201, the leveling transistor, a 40362, which provides the necessary current to the pin diode levelers. This transistor runs between the -24 and 15 volt power supplies with the impedance to the +15 volt supply being very high and the -24 supply being very low. When the transistor is forced to conduct, the emitter will tend to go negative following the output of the leveler, etc. The output of this transistor typically runs between +5 and -12 volts. -12 volts is the on condition for the pin leveler diodes and +.5 is the fully off condition. Capacitor C201 determines the frequency response of the leveler circuit. The leveling range is 10 dB front panel adjustable.

The WB-713 also incorporates an additional sweep sample leveler used to maintain constant marker amplitude over the entire output level and frequency range.

2.12 MARKER CIRCUITRY

The marker circuitry in the WB-713 is unique. It incorporates features which provide maximum marker uniformity and clarity. Limiting and bandpass shaping in IC301 A, B, and Q301, Q302 provide constant amplitude birdy markers free of noise and spurious. The zero clip level control R320 is adjusted to clip out base line noise and spurious beats but may be disabled to allow viewing of all marker responses.

The marker tilt control R331 provides a continuous 90° rotation of the marker axis. This is accomplished by summing the birdies and horizontal drive in IC301D causing the birdies to tilt.

2.13 LOW BAND MODULE

The RF sub-assemblies of the WB-713 are, of course, the most complex and unfortunately those about which it is possible to say the least. As far as basics are concerned on the low band, there is a CW oscillator, Q602 operating in a common-base configuration, tuned by C621. This oscillator's output is coupled through a tuned circuit consisting of C619 and L607, to a pair of pin diodes which are the leveling elements and connect to the output transistor from the leveling circuit previously discussed. This signal is coupled to Z601 which is a T05 can mixer. The CW oscillator runs at 700 MHz. The swept oscillator runs between 700 MHz and 1200 MHz. This oscillator runs in a common-collector configuration and is coupled through C617 to the RF port of the mixer. The two signals are heterodyned together producing an output of zero to 500 MHz and 1400 to 1900 MHz. The 1400 to 1900 MHz signal is greatly attenuated due to the low pass filter in the video amplifier input. The desired output, 0 to 500 MHz is coupled to the input stage of a five stage common-emitter broad-band amplifier. The specific characteristics of this amplifier will be discussed in further detail during the adjustment procedure. Several adjustments are provided for individual stage bias and individual stage emitter tuning. The output of the video amplifier is coupled through C825 to the pin diode band switch.

2.14 HIGH BAND MODULE

The high band consists of Q501, the oscillator, followed by a two stage buffer, Q502 and Q503. CR501 is a pin diode in the AGC loop that levels the high band output. VR554 through VR557 are tuning varactors that form a tunable low pass filter. This filter assures low harmonic distortion.

2.15 BAND SWITCH

Q401 through Q407 supply switching voltages to either the Band 1 or Band 2 pin switches. +5 volts is required to activate Band 1 and 0 volts or ground to activate Band 2 making the band switching T²L compatible.

Q401 is a saturating switch which controls the bias on the PIN drivers Q402, Q403, and Q404.

SECTION 3 OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The following paragraphs describe the location and functions of front panel and rear panel controls and preliminary operating procedures. See Figure 3-1 for the location of the front and rear panel controls.

3.2 FRONT PANEL & REAR PANEL CONTROLS

3.2.1 Center Frequency Controls: The center frequency controls adjusts the sweep center frequency of the WB-713. The small knob below and between the center frequency knobs adjusts both bands over a narrow range and acts as a center frequency vernier.

3.2.2 Pilot Light: The indicator LED provides a method of determining that the WB-713 is in operation and also acts as a dial indicator.

3.2.3 Step Attenuator #1 (Optional): This attenuator provides 0 to 70 dB attenuation in 10 dB steps.

3.2.4 Left Column Marker Switches: The three bottom switches in this column control the activation of CM-type markers which are optional, with marker frequencies of 50, 10, and 1 MHz. The top switch in this column is the 1 kHz modulation switch. When activated the RF output is modulated at a 1 kHz rate.

3.2.5 Right Column Marker Switches: These switches control the four plug-in marker sockets which may be either IM or SM type markers.

3.2.6 Vertical Marker Set: The vertical marker set control adjusts the amplitude of the vertical marker display with respect to the horizontal marker which determines the aspect of the marker tilt.

3.2.7 Marker Size: The marker size control adjusts the amplitude of all markers even when the marker tilt control is activated.

3.2.8 Marker Tilt Control: This control allows the markers to be tilted from the vertical position up to fully horizontal depending upon the setting of the vertical marker set control.

3.2.9 Marker Width: This three-position switch determines marker width. It is usually adjusted to wide position for wide sweep widths and fast sweep rates. With narrow sweep widths and slower rates it may be desirable to switch to a narrower birdie width.

3.2.10 Marker Clip: This switch when activated clips either the top or the bottom half of the birdie. This feature is very desirable when the sweep generator is used with an X-Y recorder.

3.2.11 Video (Normal-Invert) Switch: This feature allows the inversion of the scope display as desired.

3.2.12 RF Output Connector: This connector provides access to the RF output of the WB-713.

3.2.13 AC Switch/Band Selection: This switch is the on/off power switch for the unit as well as the band selection switch. It also has a position for externally selecting bands via (J102 - Pin #1) a 12 pin connector on the rear panel.

3.2.14 Sweep Width Controls: These controls adjust the RF sweep width of the WB-713 from maximum to minimum sweep width on each band to 100 kHz. Additionally there is provided a CW position which is a switch detent encountered at full counter-clockwise rotation of each control.

3.2.15 Ext-Single Trigger Switch: This switch when activated provides either triggering from an external source connected to the rear panel or triggering by means of the TRIG button located on the front panel beneath the Ext-Single Trigger switch.

3.2.16 Function Switch: This five-position switch controls the internal sweep rate of the unit. Position #1 syncs the rate to the AC line frequency and disables the rate/manual pot. Positions #2 and #3 enable selection of a rate between 100 Hz to .01 Hz. Position #4 provides for manually tuning the unit over its range by rotating the manual rate pot. Position #5 provides a rear panel terminal (J101 - Pin #10) for the application of an external low impedance drive voltage of +10 volts enabling the unit to be swept remotely.

3.2.17 Sweep Rate/Manual Control: The sweep rate control provides an adjustable repetition rate for the WB-713 between .01 Hz and 100 Hz. The rear half of this pot is used as a manual sweep control and provides for tuning the unit manually through its range.

3.2.18 Video In Connector: This connector provides a means of applying video blanking to the detected pattern and internally for the addition of the vertical marker signal.

3.2.19 Level Up/Down: This is a convenience feature of the WB-713. By adjusting two internal controls, the RF output of the unit may be increased or decreased by at least .5 dB. This allows a convenient means for checking flatness of an amplifier or other device under test.

NOTE: The following controls are located on the rear panel of the WB-713.

3.2.20 External Trigger Connector: This connector provides a means of supplying the external trigger input to the WB-713. This input will be functional only when the external single trigger switch (paragraph 3.2.15) is depressed.

3.2.21 External Marker Size Control: This control adjusts the amplitude of the marker displayed as a result of the input from the external marker generator.

3.2.22 External Programming Connectors J101 & J102: J102 and J101 are standard 12-pin tube sockets providing DC output voltages and inputs for remote programming of the WB-713.

J101

1. -24.
2. -15.
3. +5B (10 mA).
4. Monitor input.
5. Monitor output.
6. Ext level input.
7. Ground
8. Birdie output (Marker Size CT)
9. +15.
10. Ext drive input.
11. +24.
12. Blanking output.

J102

1. Band switch (WB-713) input.
2. Sawtooth out +8V.
3. Ground.
4. CT of CF pot. High Band
5. IO CF tune circuit.
6. CT of CF pot. Low Band
7. IO CF tune circuit.
8. Reference ground.
9. To Sweep Width Ckt. High Band
10. CT of Sw pot.
11. To Sweep Width Ckt. Low Band
12. CT of Sw pot.

3.2.23 Scope Vertical: This connector provides output from the WB-713 for the oscilloscope vertical input. It is here that the birdie markers are added to the scope vertical.

3.2.24 Scope Horizontal: This connector provides output to the oscilloscope horizontal drive circuitry. A voltage of approximately +7 volts is provided for horizontal drive.

3.2.25 Line Fuse: The standard line fuse is 1/2 Amp Slo-Blow. The applicable line fuse notation for the two available line voltages are screened on the rear panel. Use 1/2 Amp Slo-Blow for 110 volt line operation. Use 1/4 Amp Slo-Blow for 230 volt line operation.

3.2.26 External Marker Connector: The external marker input provides interconnection between an external marker generator and the WB-713.

3.2.27 Internal Operating Controls: There is one internal operating control which may be activated on the WB-713. It is the RF-Video blanking switch. The user may set this switch to the desired mode of blanking.

3.3 INITIAL SETUP & CHECK

Equipment required: CD-50 Detector.
Oscilloscope.
Interconnecting Cables.

3.3.1 Set:

Band Switch
Center Frequency
Attenuators If Present
Marker Switches
Marker Size
RF Output
Level (dBm)

Sweep Width
Ext-Single Trigger

Band 1.
Mid-range (low band).
0 dB.
Off.
Fully counter-clockwise.
Connect to detector.
Set to +10 (.707 volts rms
into 50 ohms).
Fully clockwise.
Off (out).

Sweep Rate Switch
Video In
Scope Vertical (Rear Panel)
Scope Horizontal (Rear Panel)

Line sync position.
To detector DC output.
To oscilloscope vertical input.
To oscilloscope horizontal
input.

Set the oscilloscope to read .1 volts per cm on the vertical scale and adjust the horizontal deflection for full screen width. The user should then see a swept display with 0 on the left and the highest frequency on the right. To verify frequency excursion, an optional HM-50 may be activated and the total frequency range checked.

3.3.2 With the HM-50 marker still on and the high band center frequency dial to mid-range, turn the band switch to Band 2. The total frequency excursion from 450 to 960 MHz should be displayed.

SECTION 4 APPLICATION

4.1 INTRODUCTION

Several applications of the WB-713 will be presented in this section. The basic information provided by the measurements are bandwidth, frequency response (gain and/or loss), VSWR, and programming. Proper interpretation of these parameters will permit detailed analysis of amplifiers, filters, cables, antennas, and other RF devices.

Extra equipment may be required for portions of the following measurements. The extra equipment is listed for each test.

The following test setups and results will be discussed:

Frequency Response & Bandwidth

- Filters
- Cavities
- Amplifiers
- Tuned Circuits
- Antennas
- Sequential Alignment Techniques

Loss Measurements Of

- Cables
- Filters

4.2 FREQUENCY RESPONSE & BANDWIDTH OF FILTERS

Perform preliminary setup as in Figure 4.6 and 4.7.

NOTE: Use slow sweep rates with high "Q" filters. Excessive sweep rate may cause distortion of the response or "ringing" of the filter under test.

4.2.1 Set an acceptable RF input level.

4.2.2 Insert frequency markers as desired.

4.2.3 Adjust the response of the filter as desired.

NOTE: To determine the filter response in dB, proceed as follows: Leave the attenuation set at the level required for undistorted filter response as in 4.2.1. Remove the device under test.

Connect the CD-51 detector to the RF output. Use a grease pencil or other suitable device and mark the position of the swept trace on the oscilloscope graticule. This position corresponds to 0 dB. Increase the attenuation in increments suitable to the job requirements and mark the position of the swept trace at each increment.

Reset the attenuation to the level in 4.2.1 above. Reconnect the device under test.

4.2.4 Read the loss characteristics directly from the oscilloscope trace.

4.3 GAIN OF AMPLIFIERS

4.3.1 Extra equipment required: Isolating network.
Electronic switch.
Variable attenuator.

4.3.2 Connect the equipment per Figure 4-1.

4.3.3 Set RF output to a level which will not overload the amplifier.

NOTE: If the amplifier to be adjusted has automatic gain control (AGC) circuitry, replace the AGC bias with a fixed bias supply.

4.3.4 Figure 4-1 depicts a method for simultaneous display of input and output levels.

4.3.5 Apply frequency markers as required.

4.3.6 Adjust the variable attenuator until the output swept trace crosses the input swept trace at the frequency of interest.

4.3.7 The attenuation reading is the amplifier gain at the frequency of interest.

NOTE: If the amplifier to be tested has AC or DC power at the input or output terminals, the use of AC or DC blocking network will be required at the following locations: Output of the amplifier and input of line power supply.

Additional equipment required. This equipment will be required for all of the following tests:

Calibrated Attenuators	Texscan KFP Series or LA Series or equivalent.
Calibrated Mismatches	Texscan MF Series or equivalent.
Calibrated RF Source	WB-713.
Electronic Switch	Jerrold/Texscan TC-2 or equivalent.
Calibrated Phase Shifter	(Special).
AC Blocking Network	Texscan DB-50 or DB-75.
Reflection Coefficient Bridge	Texscan RCB-3 or RCB-4 or equivalent.

4.4 ANTENNA MEASUREMENTS

4.4.1 Perform the preliminary setup and calibration. See Figure 4-7.

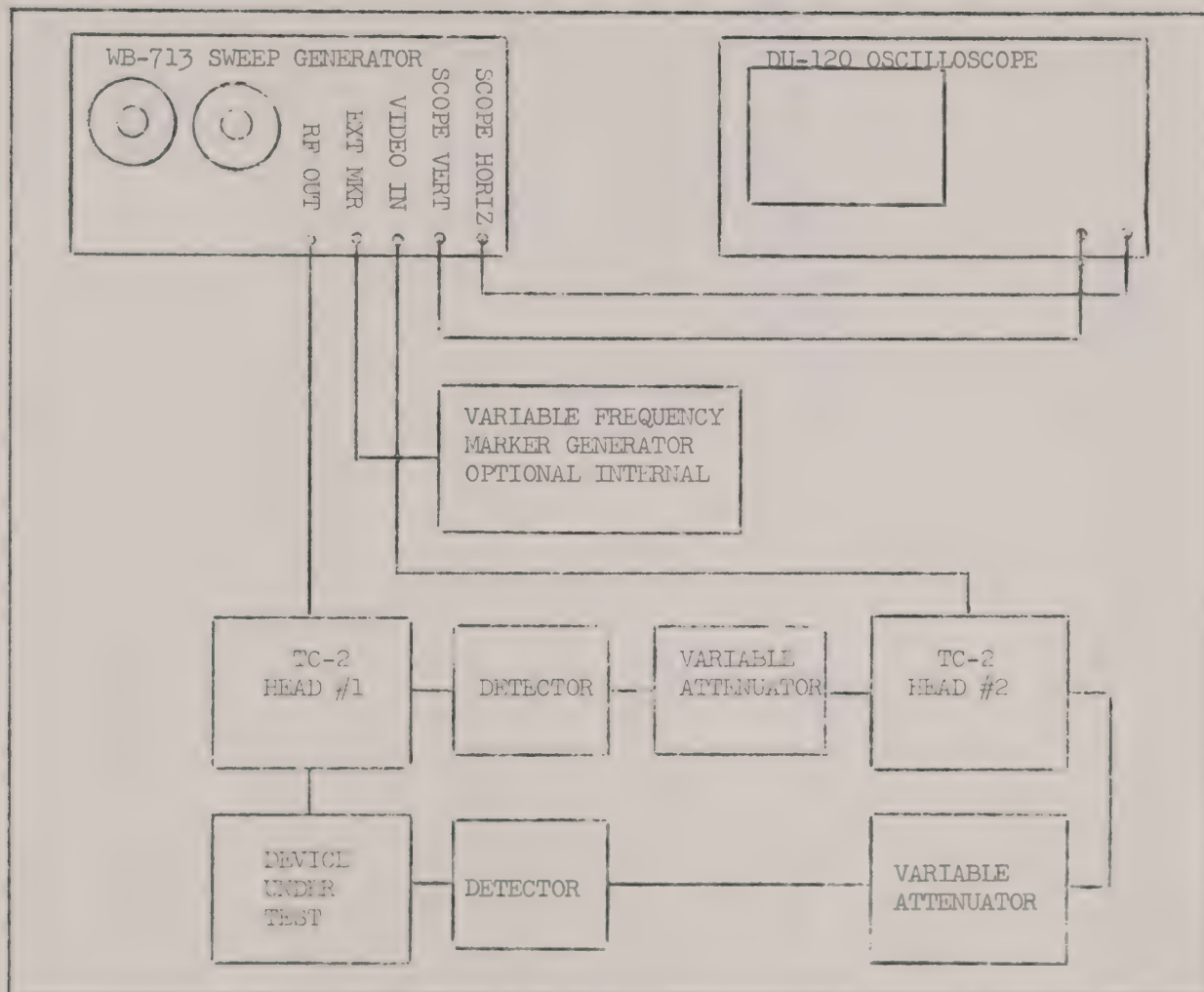


FIGURE 4-1: TEST SETUP

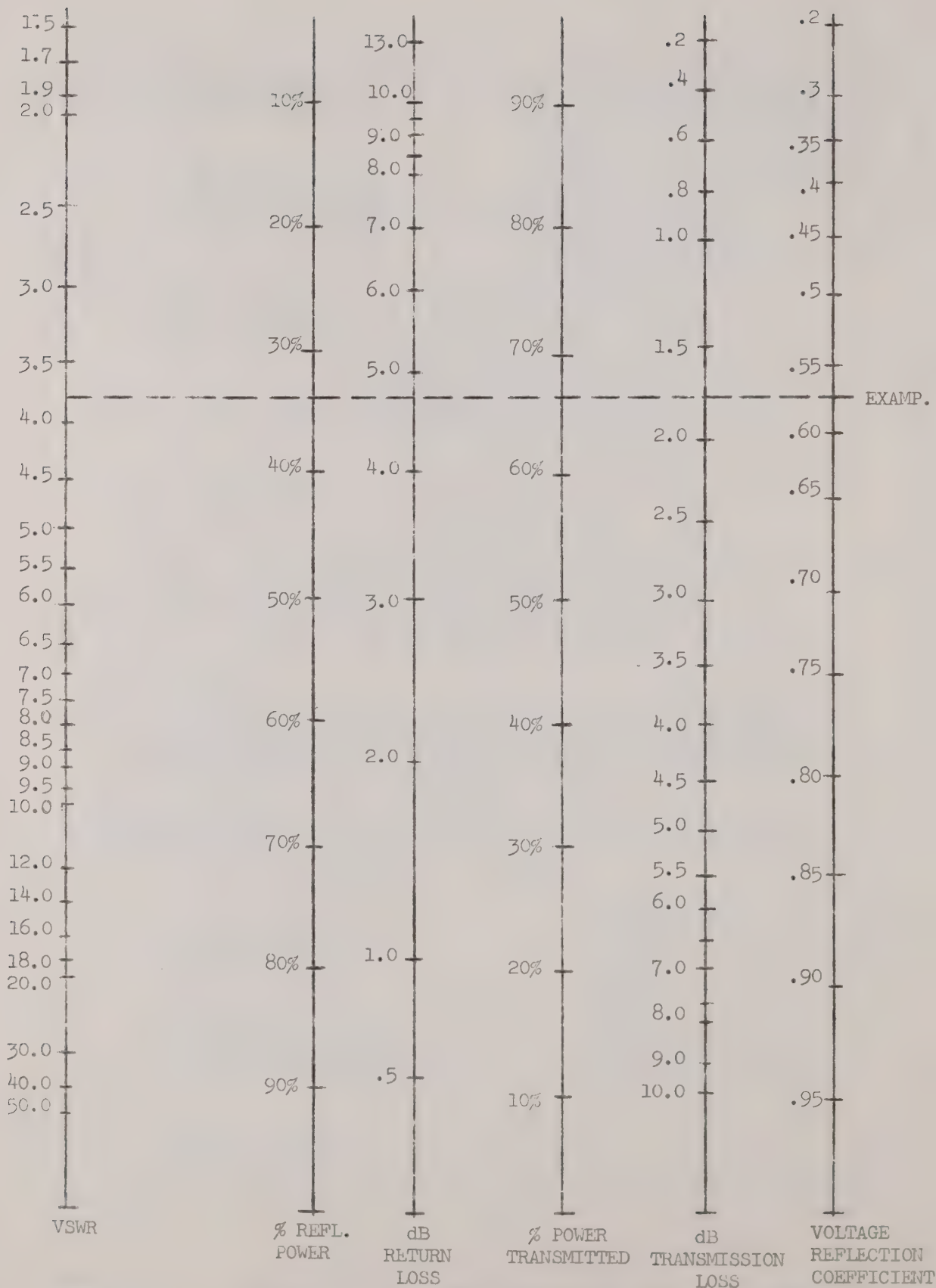


FIGURE 4-2: PARAMETERS RELATED TO VSWR
 READ PARAMETERS HORIZONTALLY (-----) EXAMP.

WB-713

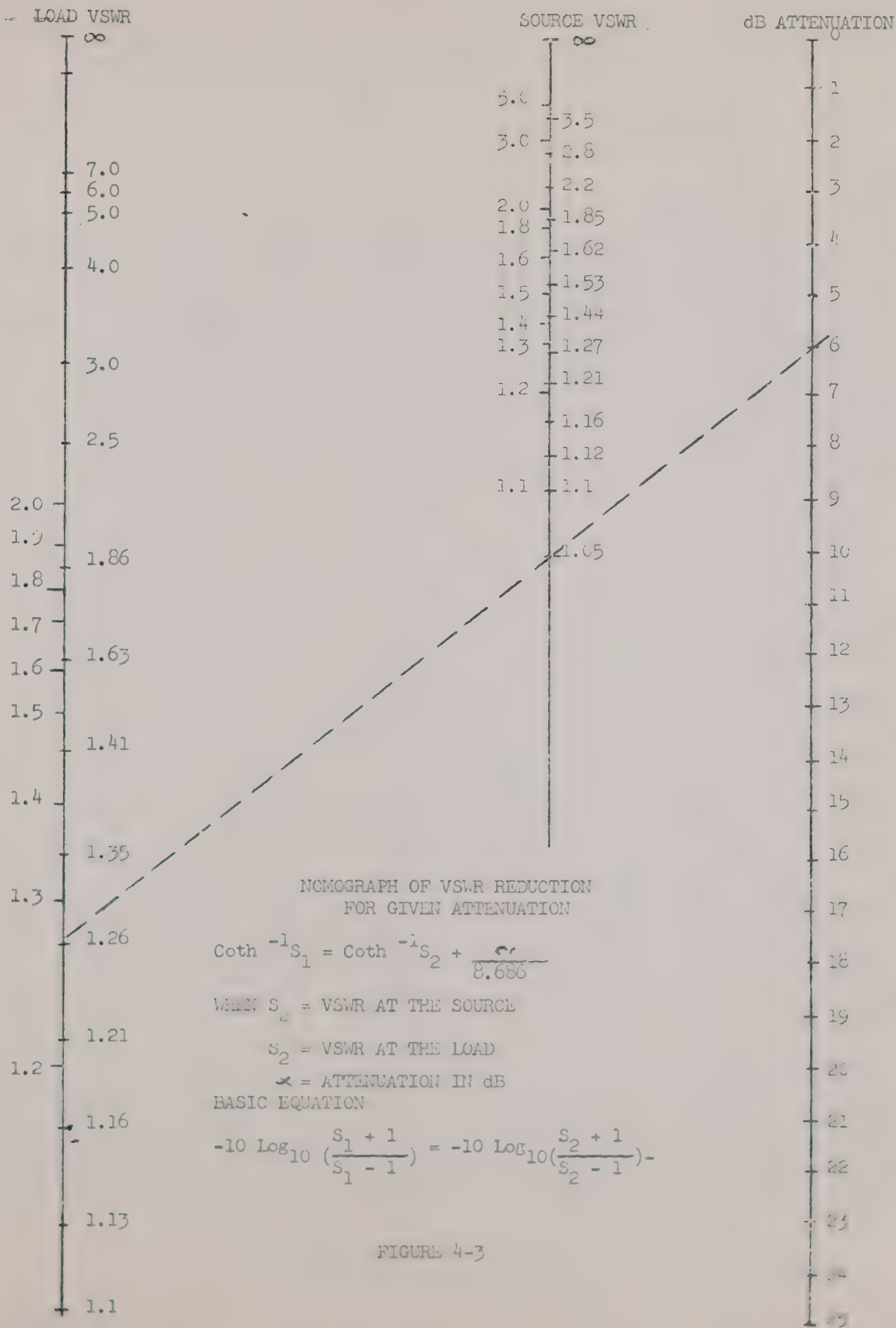
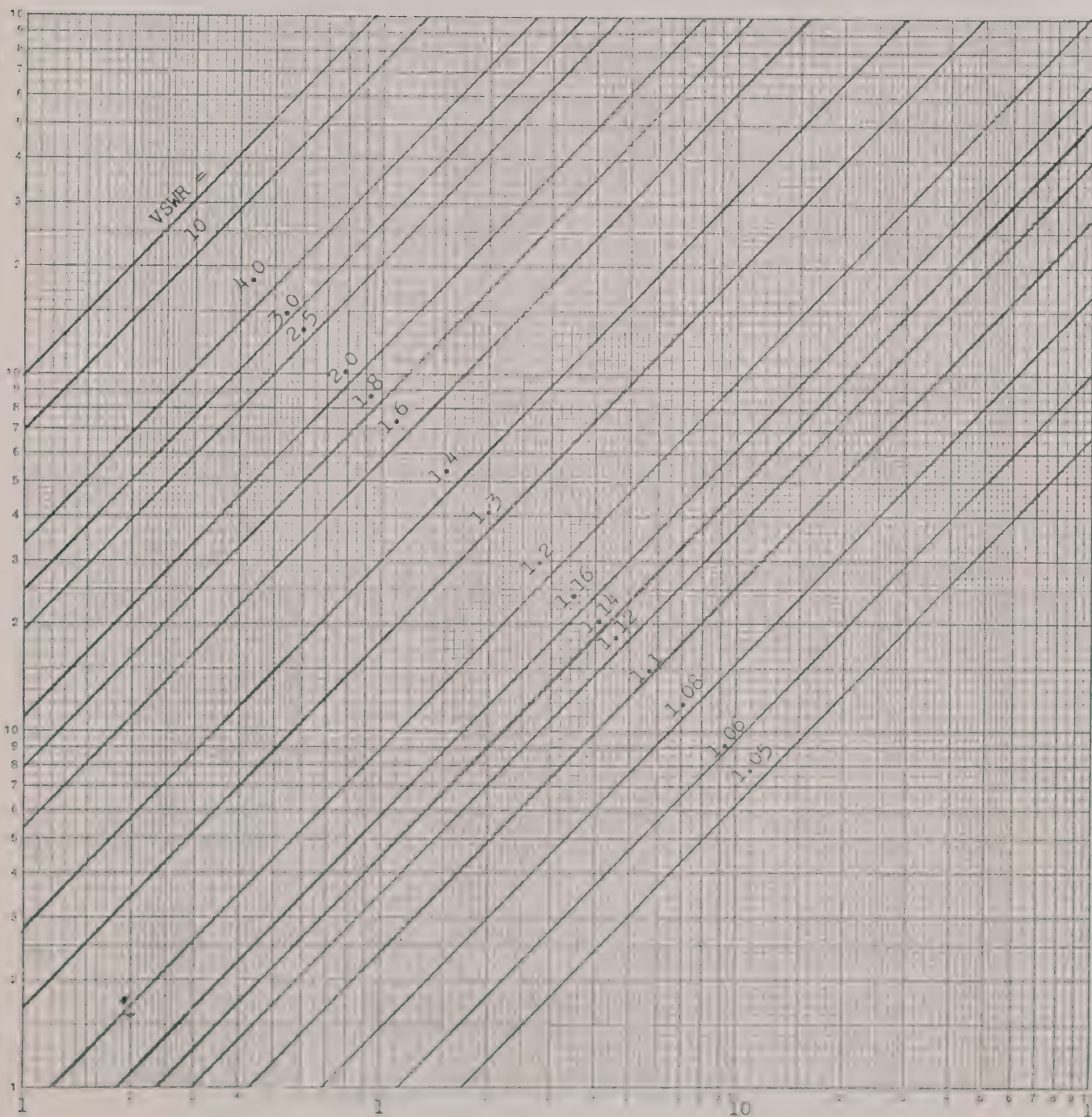


FIGURE 4-3

REJECTED POWER IN WATTS



FORWARD POWER IN WATTS
FIGURE 4-4: POWER VALUES vs VSWR

$$\text{SRL} = 20 \log \frac{V \text{ Reflected}}{V \text{ Reference}}$$

$$\text{LOSS} = -10 \log \frac{\text{VSWR}-1}{\text{VSWR}+1}$$

$\frac{V \text{ Reflected}}{V \text{ Reference}}$	SRL dB	VSWR
1.12	1	17.40
1.26	2	6.72
1.413	3	5.85
1.585	4	4.42
1.778	5	3.57
1.995	6	3.00
2.239	7	2.62
2.512	8	2.32
2.818	9	2.10
3.162	10	1.92
3.584	11	1.78
3.981	12	1.67
4.467	13	1.58
5.013	14	1.50
5.623	15	1.43
6.310	16	1.38
7.079	17	1.33
7.943	18	1.29
8.931	19	1.25
10.00	20	1.22
11.22	21	1.20
12.59	22	1.17
14.13	23	1.15
15.85	24	1.13
17.78	25	1.12
19.95	26	1.11
22.39	27	1.09
25.12	28	1.08
28.18	29	1.07
31.62	30	1.06
35.48	31	1.058
39.81	32	1.051
44.67	33	1.046
50.12	34	1.041
56.23	35	1.036
63.10	36	1.032
70.79	37	1.029
79.43	38	1.026

VSWR	INSERTION LOSS
1.05	-16.3
1.1	-13.2
1.2	-10.4
1.3	- 8.7
1.4	- 7.8
1.5	- 7.0
1.6	- 6.4
1.7	- 5.9
1.8	- 5.5
1.9	- 5.1
2.0	- 4.8
2.5	- 3.7
3.0	- 3.0
3.5	- 2.6
4.0	- 2.2
4.5	- 1.9
5	- 1.8
6	- 1.5
7	- 1.2
8	- 1.1
9	- .96
10	- .88
20	- .43
30	- .29
40	- .23

FIGURE 4-5: TABLE OF STRUCTURAL RETURN LOSS
AND INSERTION LOSS VS. VSWR

4.4.2 Connect the antenna to be tested to Z2 on the reflection bridge.

4.4.3 Read the VSWR from the oscilloscope.

4.4.4 Insert markers to determine the frequency versus VSWR characteristics of the antenna under test.

4.4.5 If the length of cable between the antenna and the RCB is great, the apparent VSWR at the bridge is not true antenna VSWR. Refer to Figure 4-3 for VSWR reduction versus cable attenuation. A method of determining cable attenuation is provided in a following section. Manufacturers data may also be consulted for attenuation characteristics of a particular cable.

Consult Figure 4-4 for correlation of power loss due to VSWR.

4.5 STRUCTURAL RETURN LOSS OF CABLE

Structural return loss (SRL) is caused by imperfections in cable construction. Reflections occur from variations in cable diameter, dielectric imperfections, sharp bends, conductor misplacement, etc. These reflections prevent a certain portion of the incident power from reaching the load. Structural return loss is a measure of the quality of a cable.

NOTE: Structural return loss and load mismatch constitute return loss. The cable must be terminated properly to eliminate mismatch errors from an SRL measurement.

4.5.1 Perform the initial setup and calibration. See Figure 4-7.

4.5.2 Terminate the cable in its characteristic impedance.

4.5.3 Connect the cable to Z2 of the reflection coefficient bridge.

4.5.4 Measure the VSWR at the frequency desired.

4.5.5 Refer to Figure 4-5 and read SRL in terms of observed VSWR.

NOTE: The signal must be leveled at the bridge input to maintain a 50-ohm source impedance. If the sweep generator is leveled internally, and not at the bridge input, the source impedance of the bridge is 83.3 ohms.

4.6 INSERTION LOSS

In cables, insertion loss is comprised of resistive losses (Skin effect) and dielectric losses. Each of these parameters increases with frequency. In filters, the lumped constants have similar losses. The insertion loss may be determined by observing the reflection from an open or short circuit output. The initial assumption is that the cable or device is matched to the generator.

- 4.6.1 Perform the initial setup and calibration.
- 4.6.2 Open circuit (or short circuit) one end of the device.
- 4.6.3 Connect the device of Z2 of the reflection coefficient bridge.
- 4.6.4 Read the VSWR at the desired frequency.
- 4.6.5 Refer to Figure 4-5 for correlation of VSWR to insertion loss.

4.7 DETERMINATION OF AMPLITUDE & PHASE MEASUREMENT

- 4.7.1 Set up the equipment as shown in Figure 4-6.

NOTE: A dual trace oscilloscope may be used instead of an electronic switch, however, only one channel will have marker capability. This provides simultaneous monitoring of input and output characteristics for matching purposes.

4.7.2 Remove both the known and unknown devices, connecting the attenuators directly to the RCB.

4.7.3 Adjust the variable attenuator and variable phase shifter to obtain a null in output from the RCB-3.

- 4.7.4 Insert the known and unknown devices per Figure 4-6.

4.7.5 Adjust the device under test (unknown) until a null is observed at the frequency of interest. The unknown device will now match the known device in attenuation and phase angle.

4.7.6 Adjust the variable attenuator and variable phase shifter to obtain a null from RCB-3. The difference in attenuation between the fixed attenuator and the variable attenuator indicates attenuation or gain of the device under test. The difference between the fixed phase shifter and the variable phase shifter is the phase shift induced by the device under test.

4.8 EXTERNAL PROGRAMMING & LEVELING

The WB-713 with its various programming functions, provides the user with greatly increased capabilities over other types of sweep generating systems insofar as flexibility and automated or semi-automated test systems are concerned. The WB-713 offers the user the following programmable options:

4.8.1 Center frequency programming, leveler programming, rate programming, and remote band switching. The list of programming setups shown in Figure 4-10, should explain the various hookups. Either internal or user supplied voltage may be used. Caution should be used when using other than internal voltages since hum modulation may occur. Unit reference ground should be used in all cases.

These various programming features provide for several possibilities of applications, one being the possibility of complete television or communication receiver alignments at one test station. It is possible to semi-

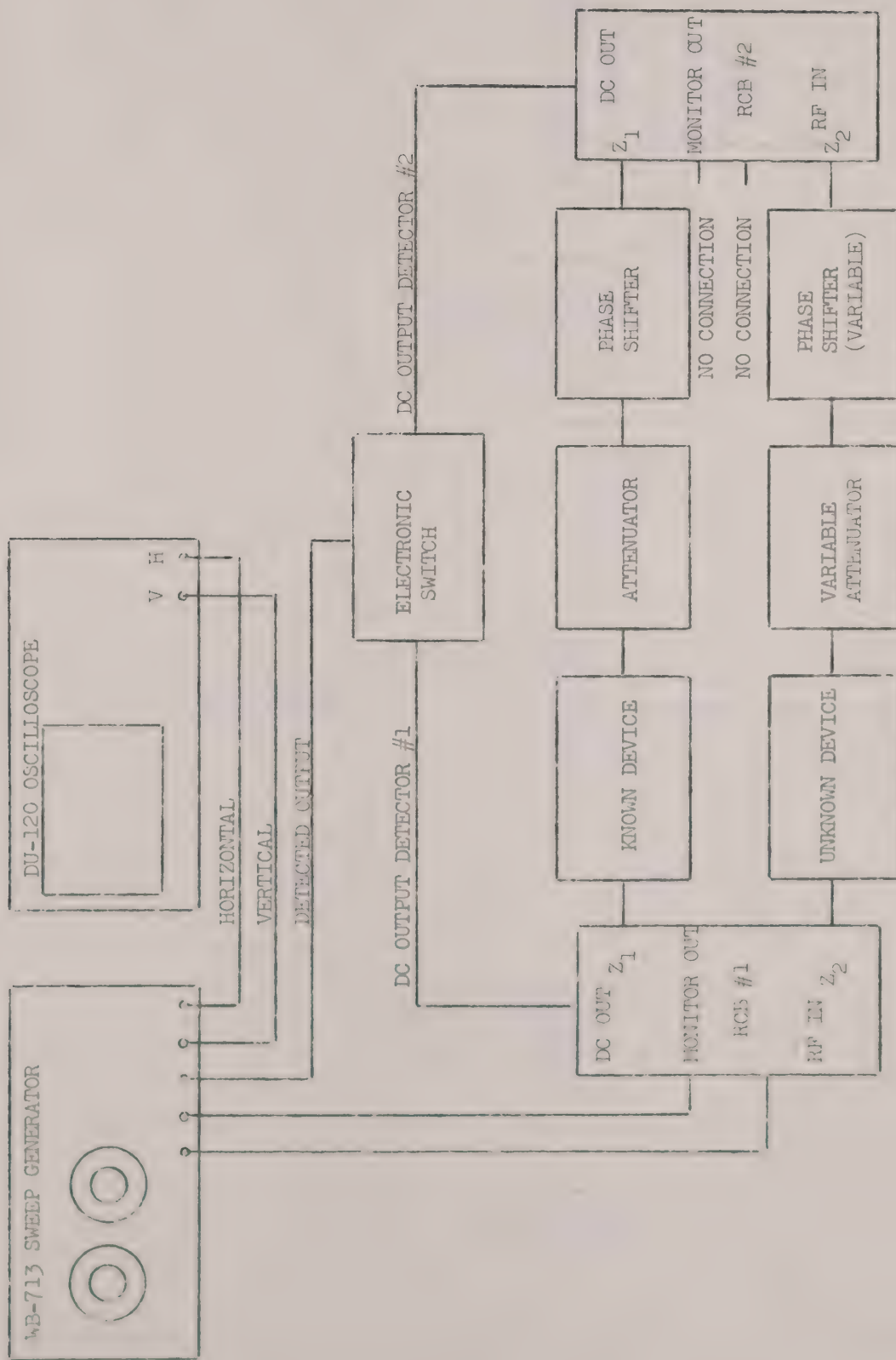


FIGURE 4-6: SETUP FOR DETERMINING AMPLITUDE AND PHASE CHARACTERISTICS

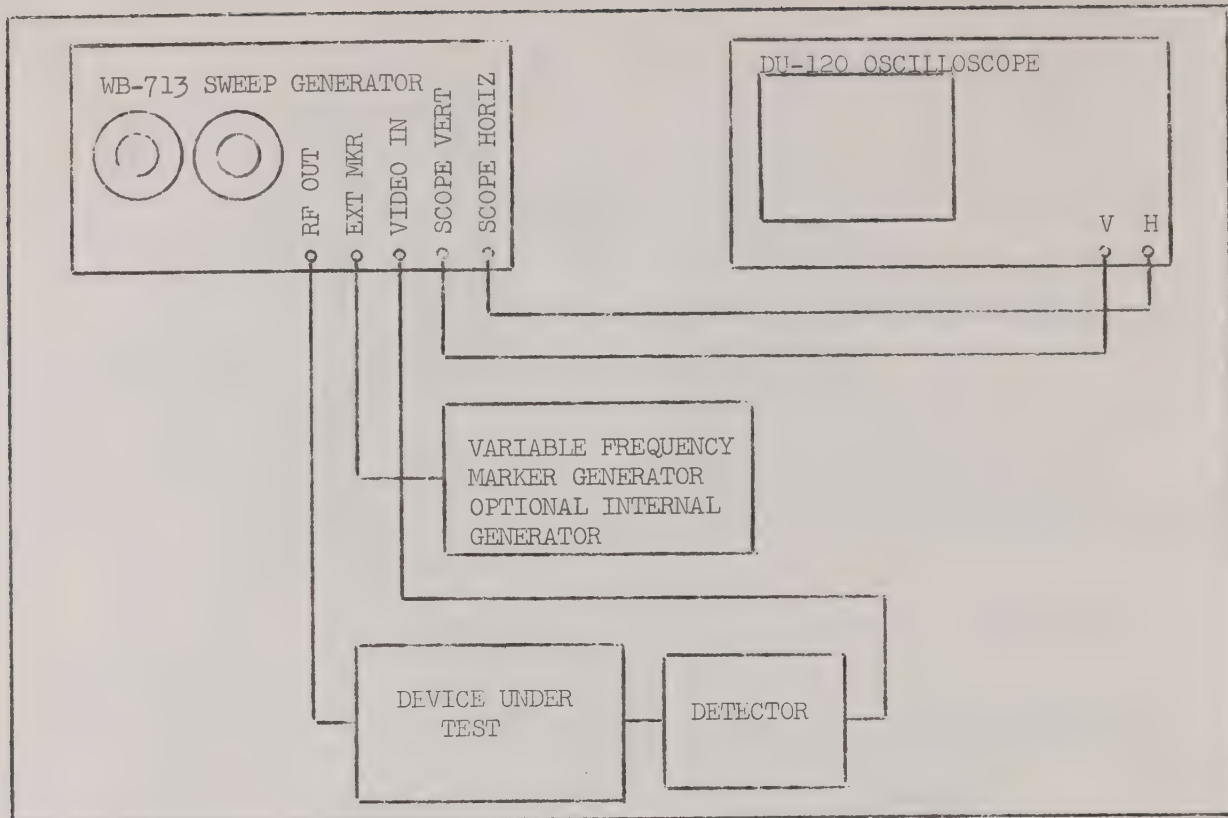


FIGURE 4-7: TEST SETUP

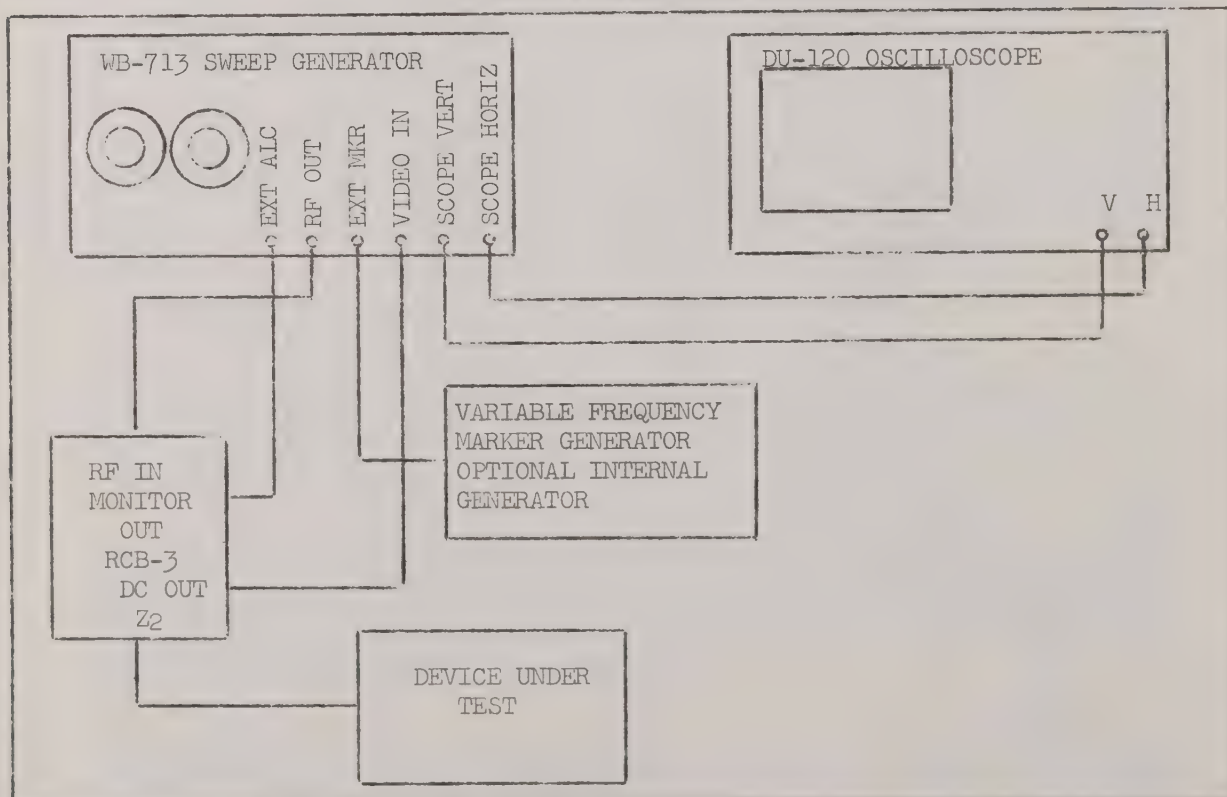


FIGURE 4-8: SETUP USING REFLECTION COEFFICIENT BRIDGE

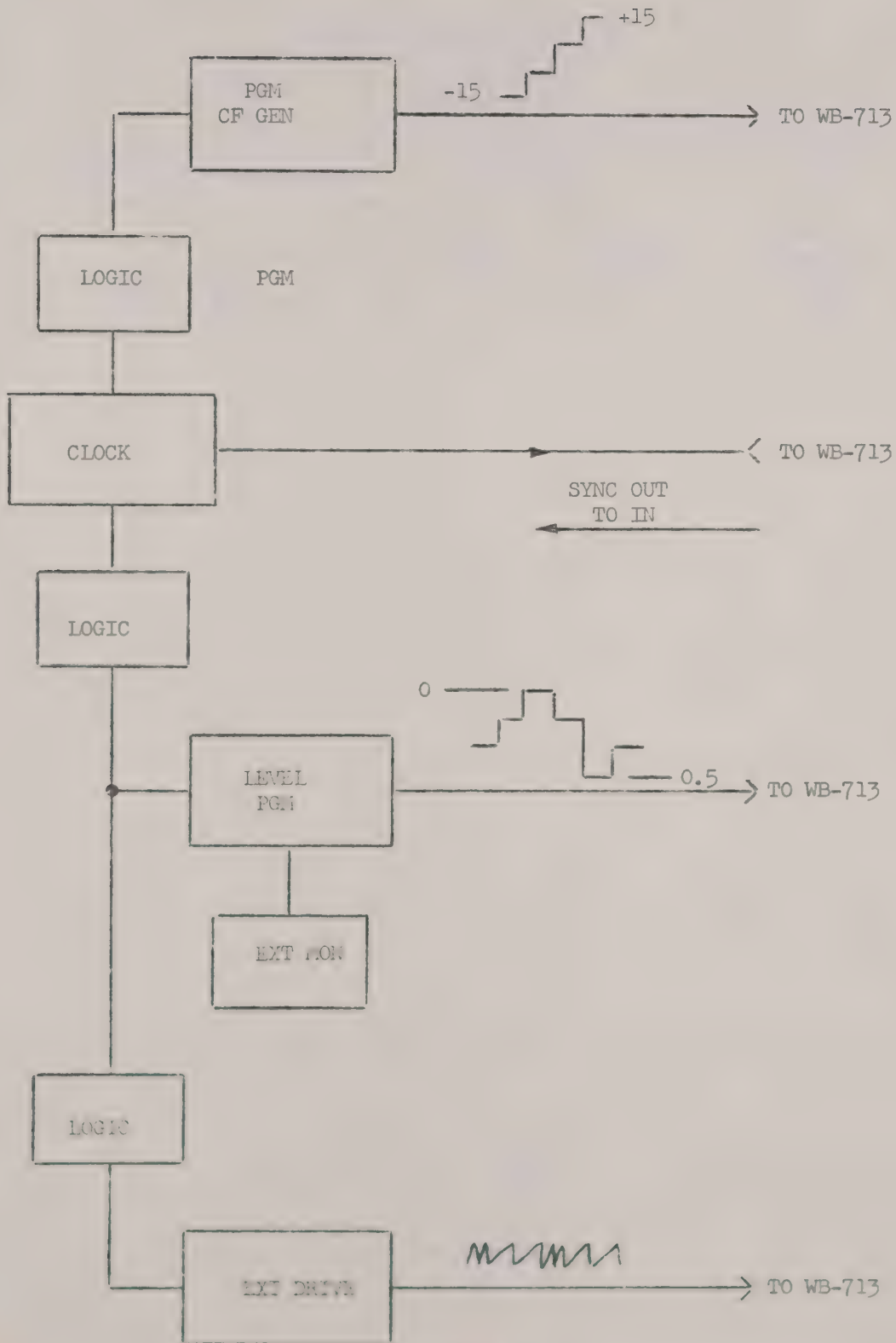
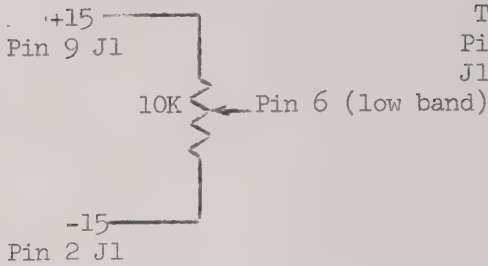


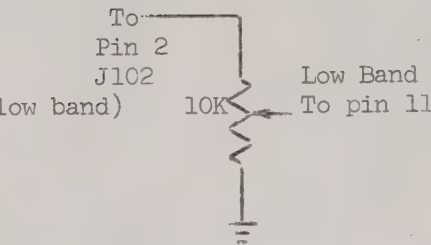
FIGURE 4-9

REMOTE PROGRAMMING SETUPS

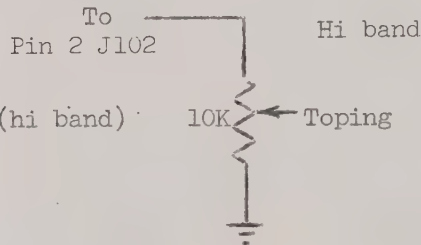
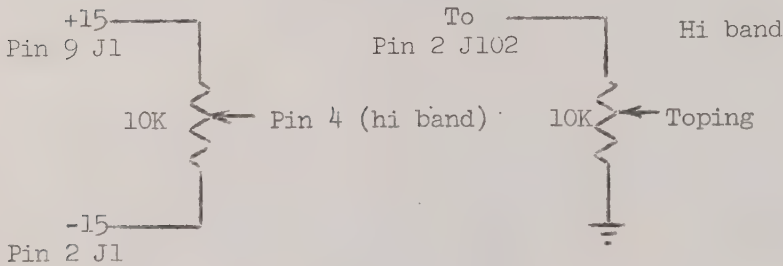
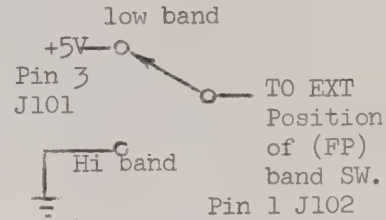
EXT CF TUNE



EXT SWEEP WIDTH ckt

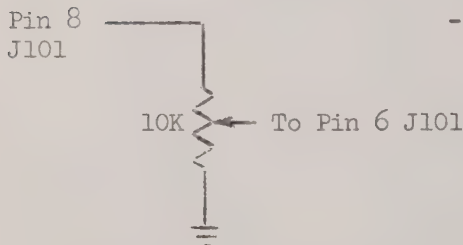


BAND SWITCH

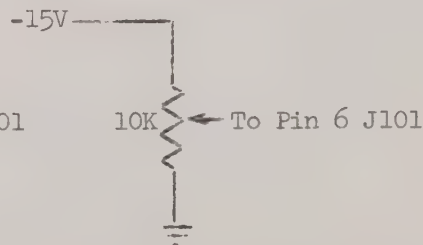


For EXT rate drive a sawtooth of approx. ± 8 volts may be applied to Pin 10 of J101.
NOTE: The front panel rate switch must be in EXT rate position.

RF MARKER HOOKUP



EXT LEVEL INPUT



NOTE: Mkr size pot on front panel must be turned down.

NOTE: FP Vernier atten control must be in max. CW position. Gives approx. 10 dB leveling action.

FIGURE 4-10

automate these test procedures or possibly to fully automate them if additional interfacing equipments are available for measuring and recording the required outputs. Another possible application is the alignment of tracking bandpass filters, which may be either mechanically tuned or electrically tuned. It is possible to utilize the slow sweep rate of the WB-713 to provide X-Y recorder outputs or possibly computer interface outputs from the unit under test. Figure 4-9 shows a block diagram of a possible system which might be applicable to those measurements previously mentioned.

4.8.2 Possible applications are: Alignment of 0 phase shift filters; comparison of filter attenuation and phase to a quality assurance standard, or other specifications, and adjustment of amplifiers for gain and phase shift.

SECTION 5 ALIGNMENT

5.1 INTRODUCTION

This procedure differs from the preceding sections in that a more specific sequence will be given to actually perform the checkout operation.

5.2 POWER CORD

A standard check should be made of the line cord to insure that neither of the hot prongs is connected to chassis ground and that the grounding plug is, in fact, connected to the chassis. This unit will be somewhat different from normal, and a note of caution should be made at this point that the chassis is not ground for the power supply. The power supply is all run off reference ground which is zero potential, but it is isolated from the chassis. Therefore, when any voltage measurements are taken other than this line cord check, the ground lead to the meter should be connected to one of the reference ground terminals. Checkout procedure for the unit proceeds after the line cord check to determine that the unit is in 115 volt AC position. For 230 volt operation, place the rear panel slide switch in the 230 volt position. Fuse F1 is in series with the power line to prevent overload from destroying the transformer. For 230 volt operation, the fuse should be changed to a value indicated on the rear panel.

NOTE: Before power supplies are checked, the unit should be turned off and a short circuit test should be made by connecting an ohmmeter between reference ground and the individual power supplies to check for shorts.

NOTE: All supplies are monitored at J101 on the rear panel.

5.3 +24 VOLT POWER SUPPLIES

The positive and negative 24 volt power supplies have no adjustment. They are a go-no-go situation. The test should be performed as follows. Connect the power line plug P1 to a Variac; increase the Variac voltage slowly while monitoring the output of the +24 volt supply. As the Variac voltage reaches approximately 90 volts, the output should cease to increase at a value very near 24 volts. The tolerance on this voltage is $\pm 1\text{V}$; that is, the output may be 23 to 25 volts under these conditions. However, as the input voltage to the IC regulators varies between 27 and 38 volts, the output voltage change should be only 240 millivolts. With input voltages between 30 volts and 36 volts, the line regulation should be 120 mV. With load current between 250 mA and 750 mA, the regulation should be approximately 120 millivolts; that is, it may be possible under some conditions to see 120 millivolts of ripple on this supply. This integrated circuit contains internal thermal overload and internal short circuit current limiting. It will fold itself back to about 2 volts if 1 ampere of current is exceeded at any time. If difficulty is encountered with these supplies, the only action could be to check the passive components R1, C1, and C2 and the bridge rectifier. If no fault can be determined, the fault must be in the IC regulator and it should be replaced.

5.4 +15 VOLT POWER SUPPLY

A digital voltmeter should be connected to the +15 volt output point which is the junction of R7 and R8.

The adjusting pot of the +15 power supply is R5. With the +24 volt supply energized and the digital voltmeter connected between reference ground and the +15 output, adjust R5 until 15 volts $\pm$.1 volt is obtained. If difficulty is encountered with this power supply, be certain that measurements are taken against reference ground. Also, the theory of operation section may be consulted for troubleshooting hints. The maximum allowable ripple on the +15 volt power supply is 1/2 millivolt. These supplies must be very stiff in order that residual FM specifications may be met later in the test program.

5.5 -15 VOLT POWER SUPPLY

The -15 volt power supply like the +15 is run directly off the output of the regulated -24 volt supply. The reference point, the junction of R17 and R18, should be very nearly zero volts. The amount by which this departs from zero volts will be determined by the absolute value of R17 and R18, the summing resistors, and the accuracy with which the +15 volt supply is set. That is, the -15 volt supply will vary depending upon the actual output voltage of the +15 supply. The circuit is connected in this configuration for hum cancellation between the plus and minus 15V supplies. The allowable output ripple on the -15 supply is 1/2 millivolt.

5.6 +5 VOLT POWER SUPPLY

There are two +5 volt supplies called A and B. Supply A is obtained by a series zener off the +15 supply. The accuracy depends on the zener diode and is about 10%. Therefore, the +5 volt (A) supply could be as low as 4 volts and as high as 6. In Supply B, there is an integrated circuit type supply. The total accuracy is about $\pm$ 2%. There is no ripple specification on the output of the 5 volt supplies.

5.7 RATE CIRCUIT TUNE-UP

The rate circuit adjustments are straightforward. The rate limit pot R113 on the main printed circuit board is adjusted observing the oscilloscope to allow an output ramp of 16 milliseconds peak-to-peak. This adjustment is made with rate switch S102 in line sync position. A 16.7 millisecond peak-to-peak ramp should be observed when proper adjustment is accomplished. Turn rate switch to .1 to 100 position. The rate circuit pot should be set to maximum. Observe that the trace happens .7 times per second. Activate the external trigger-single trigger switch and depress the trigger button on the front panel. The unit should make one complete cycle and stop, waiting for the trigger button to be pressed again. Insert a triangular waveform or sinusoidal waveform (or square-wave) in the external trigger input on the rear panel, and observe that the unit will trigger on this input. The unit should trigger with an input as small as a half volt positive and negative; that is, a one volt waveform should be sufficient to cause the unit to trigger. The output of

the rate circuit should be a triangular wave which is basically symmetrical. It operates 18 volts peak-to-peak around zero, a + to -9 volt ramp. The .1 to 100 and .1 to .01 positions of the rate switch have no adjustments but should exceed specifications on each end of the potentiometer rotation.

5.8 VARACTOR DRIVE

The varactor drive voltage should be monitored at Pin 2 of J102. By adjusting the sweep width centering and center frequency span, it should be possible to obtain a ramp which runs from approximately +5 to -12 volts. To change centering (the frequency at which the center frequency dial indicates when the sweep width pot is turned to minimum), increase or decrease in value R125 or R126 for high band and R143 and R143 on the low band.

To change center frequency span (the number of degrees rotation it takes for the center frequency controls to tune the frequency range), R134 on the low band and R143 on the high band should either be increased or decreased. The above resistors are factory selected values and normally do not require changing. Only when extreme dial inaccuracies are encountered should these values be adjusted.

5.9 CW OSCILLATOR (BAND 1)

The CW oscillator (Q602) operates off a single +15 volt supply. Determine that the +15 volts supply is present at the input of C605. By probing near the tuned line L608 with a detector and probe some indication of RF output should be obtained. As the amount of output required for this oscillator is determined by overall system response, no definite value will be given at this time. However, the oscillator should tune smoothly and evenly over the frequency range of at least 200 (600-800) MHz by adjusting C621. Approximately 700 MHz is the correct frequency. At this time, check the leveler output at C604. The leveler voltage should be largely negative at this point (some value near -10 to -12 volts negative at this time).

CAUTION: Avoid pressure on the 5109 transistor that might short the case to the leads.

5.10 SWEEP OSCILLATOR (BAND 1)

The sweep oscillator operates between 700 and 1200 MHz and should be checked on a spectrum analyzer for this frequency range. In order to make measurements on this oscillator, it is best to loosely couple the oscillator to a spectrum analyzer. Utilize a connector with a low value resistor soldered to the end to make an antenna. Observe the output on the spectrum analyzer and adjust the varactor drive over its range observing that the oscillator sweeps in the neighborhood of 700-1200 MHz for the WB-713. The exact frequency is not critical. The oscillator could go as low as 650 MHz so long as its minimum frequency is that which can be obtained by adjusting the CW oscillator. The tuned line is the varactor lead itself. If it is necessary to go lower in frequency, the varactors will have to be unsoldered and stretched out very slightly. If it is necessary to go higher, the converse is true; that is, the varactor leads will have to be shortened and the junctions of the varactors should have a solder ball on

them to minimize the inductance. The coupling will be adjusted at a later time. The exact amount of coupling will be explained later under final tuning.

5.11 VIDEO AMPLIFIER

During the tune-up of the video amplifier, blanking should be in the video blanking position. This applies constant DC voltage to the video amplifier input terminals. To test the video amplifier, unplug it from the VHF oscillator/switch assembly and install test cables.

Connect the test cable to the input of the video amplifier. Connect a 0 to 500 MHz signal source (such as Texscan WB-711) to the video amplifier input. The detector for the RF should be connected to the output jack of the video amplifier and displayed on the oscilloscope as in Figure 4-7. Determine a 40 dB reference level. That is, if the output of the signal source is 0.5 volt, this reference level should be marked on the oscilloscope. Then 40 dB of attenuation should be inserted between the signal source and the WB-713 video amplifier. The amplifier should be tuned in the following manner to achieve 40 dB gain across the band. Maximum flatness should be about 6 dB.

NOTE: In the tune-up of this video amplifier, one thought should be foremost in the mind of the operator and that is THINK "MAX FREQUENCY" FROM THE INPUT TUNING TO THE END OF THE AMPLIFIER. EVERY EFFORT SHOULD BE MADE TO ACHIEVE GAIN AT THE HIGH END.

Once this gain at the high end has been achieved, it is easy to reduce excess low-end or mid-band gain and achieve the unleveled flatness specified. The method for tuning up the video amplifier is to apply a signal of sufficient amplitude to achieve a small output on the oscilloscope so that results of tuning actions may be seen. First, adjust bias pots in this sequence R806, R812, R852, and R853. During certain bias conditions of R852, it may be possible to bias the SD1300 into thermal runaway. If this should occur, because of the characteristics of a particular transistor, that transistor emitter resistor should be raised to the next higher value of resistance until the point of thermal runaway can be avoided. This amplifier has shown very little tendency to oscillate. Any tendency that has been seen can be counteracted by placing the cover on the video amplifier. Adjust each of the bias pots in turn observing the output on the oscilloscope for maximum gain at 500 MHz. It will be necessary as the bias pots are brought into proper operating range to reduce the input from the signal source. If difficulty is encountered at this point, it will be necessary to go into the video amplifier with a high-impedance detector to determine the defective stage. Normal troubleshooting voltage measurements should be made to determine the cause of difficulty at this point. Once the bias pots have been adjusted, each emitter bypass capacitor should be adjusted in turn beginning with the first stage: C804, C808, C819, C815, C818, C822, and C821. The last tuning capacitor mentioned controls the cutoff of the amplifier. Improper adjustment will cause the amplifier to cutoff as short as 300 MHz. If it is necessary to perform further adjustments on the video amplifier in order to make the specified minimum gain at 500 MHz, the following can be utilized as a point of

reference. The main items determining the frequency response of this amplifier are the emitter bypass capacitors. It is permissible to attach small ceramic capacitors to the emitters of each of the stages to ground. These values should never be larger than 27 pF and smaller values will be beneficial at the higher frequencies. Each successive stage should be checked to determine that maximum gain at 500 MHz has been achieved at that particular stage. That is, beginning with Q801, adjust its emitter tuning capacitor and its bias network for maximum response at 500 MHz. Increase the output of the VS-50 and observe if the output from the video amplifier increases at 500 MHz. If it does so, this indicates that maximum gain has not yet been obtained and another value capacitor should be inserted and try again. Increasing the output of the signal source and seeing no increase in output of the video amplifier indicates that a particular stage is saturated at that frequency. This procedure should be repeated throughout each stage of the video amplifier until approximately 40 dB gain is achieved at 500 MHz. The overall flatness of the amplifiers can then be observed and if excessive output is found to exist at the extreme low end (the first 50 MHz), remove the lead between R854 and C842 which is a 4.7 ohm and .01 uF combination in one emitter to the final stage of the video amplifier. This is the main controlling factor of low-end gain. In order to determine mid-band gain, it may be necessary to adjust the value of the feedback resistors R803, R808, R849, and R817. Selection of these values either higher or lower should make it possible to tailor the gain of the video amplifier until it is at least 6 dB flat over the range. It would be highly desirable if this flatness could be improved to 3 dB. However, the leveler should have sufficient range to handle 6 dB.

5.12 MIXER OUTPUT

(The output from the monitor diode should be disconnected during this period). The output of the mixer should be observed on the spectrum analyzer. This is done by connecting a test cable from the mixer output connector and transforming to the proper connector size. The output of the mixer should be reasonably flat from zero to 500 MHz. The flatness will be related, of course, to the flatness of the CW oscillator and the effect that the surrounding components have on it. During this step, all power supplies should be reconnected. Observe the output and adjust C619 for maximum output consistent with minimum harmonic content. Harmonics will be bad at this point because all shields are off and good harmonic content cannot be achieved until all shields are in place. This test is merely to verify that the mixer is producing the correct range of frequencies. At this point, connect the video amplifier to the VHF oscillator. If in the steps to come, excessive harmonics and spurious content are generated, it is permissible to connect a small axial-lead ceramic capacitor of 2 to 3 pF from the DC output port of the mixer to ground. These leads should be kept as short as possible to ground, and also form a small loop to make a conductor connected to Pin 4. It is now time to observe the composite output of the unit. The composite output of the sweep generator should now be observed on the oscilloscope and each of the interior adjustments should be operated to achieve a maximum flatness consistent with full output at 500 MHz. As the output of this unit is required to be .7 volts, the unlevelled output should be at least .75 volts. Once the composite output unlevelled has been determined to

be sufficient, the monitor diode connection should be returned and the output waveform from the monitor diode should be applied to the leveler circuit.

Adjustment of the maximum and minimum pots of the leveler circuit, which are on the main printed circuit board should then be made to give the following conditions: With the front panel level control pot fully clockwise, adjust the main control until a leveling action is observed.

Rotate the pot counter-clockwise and observe that the output begins to fall downward. Adjust the minimum pot further until 0.2 volt output has been observed. Rotate the front panel control fully clockwise and adjust the maximum pot for .707 volts output. The actual figure required is a power meter measurement of 10 dBm and each individual detector to be used in this operation is to be calibrated against a power meter. The detector should be calibrated against a standard power meter so that the exact detected output voltage can be correlated in terms of dBm or dBmV. One method of determining an exact 10 dB down measurement is to make maximum measurement and then insert a 10 dB pad in series with the detector and observe the detected output 10 dB down. Then remove the detector and adjust the maximum and minimum pots for this setting. There is interaction between the maximum and minimum pots and the up-and-down measurement will have to be repeated at least twice to achieve the correct leveling action.

Oscillation of the leveler may occur in some units. It has been determined that approximately 200 or 250 pF capacitor connected between Pins 2 and 6 of the leveler IC201 will correct this deficiency. The minimum value capacitor required to stop the oscillation should be used as maximum leveler frequency response will be required near the low end of the units, because of large excursions of the output signal. If at this point, the unit is in fact making output specifications and leveling specifications, the blanking should be checked. Observe the trace in video blanking and ascertain that it is in fact being blanked off during retrace. Change the switch to RF, and observe an RF blanking pattern. A 15 volt squarewave should be visible on the 15 volt lead to the video amplifier as this is the power supply which is blanked off.

5.13 SWEEP OSCILLATOR (BAND 2)

The sweep oscillator operates between 450 and 960 MHz. With the band switch in Band 2 position and the unit on, remove the Band 2 oscillator cover. (NOTE: Band 2 is located below the chassis). Use a probe and spectrum analyzer as in Band 1 sweep oscillator checkout. With sweep width control in CW position, rotate Band 2 center frequency dial through its range. Observe the analyzer for 450 to 960 MHz tuning range. If no output is observed, use normal troubleshooting procedures such as checking for loose connections, measuring bias on the oscillator transistor, etc. (NOTE: Check all voltages on oscillator before changing any parts).

If the oscillator appears to be tuning properly and the unit does not have RF output, the buffer amplifiers may be at fault. Again measure bias of Q502 and Q503. If measurements seem to be in order, the pin diode CR501

may be open or not conducting. When operating properly, the pin diode voltage should be approximately $-.5V$ at C522 with RF level turned to maximum position. Circuitry after the pin leveling diode consists of a sweeping filter as indicated earlier. Complete loss of output through this section would be unusual except for a loose solder connection or possible short. Adjustment of the trimmers may be needed to compensate for loss of output due to aging or mechanical vibration.

SECTION 6

DOCUMENTATION

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>CAPACITORS DESCRIPTION</u>
C1	012-224	450 uF,90V
C2	012-016	100 uF,40V
C3	012-291	1 uF,35V
C4	012-291	1 uF,35V
C5	012-113	350 uF,15V
C7	012-224	450 uF,90V
C8	012-016	100 uF,40V
C9	012-999	Factory Selected Value
C11	012-291	1 uF,35V
C12	012-081	25 uF,50V
C13	012-113	350 uF,15V
C101	012-150	120 pF
C102	012-050	.01 uF
C103	012-114	.02 uF
C104	012-114	.02 uF
C105	012-114	.02 uF
C106	012-272	.68 uF
C107	012-276	10 uF,35V
C108	012-276	10 uF,35V
C201	012-143	220 pF
C202	012-050	.01 uF
C203	012-050	.01 uF
C301	012-050	.01 uF
C302	012-050	.01 uF
C303	012-050	.01 uF
C304	012-050	.01 uF
C305	012-085	.005 uF
C306	012-009	1000 pF
C307	012-095	330 pF
C308	012-085	.005 uF
C309	012-085	.005 uF
C311	012-276	10 uF,25V
C312	012-276	10 uF,25V
C313	012-143	220 pF
C351	012-030	27 pF
C375	012-143	220 pF
C376	012-050	.01 uF
C377	012-050	.01 uF
C501	012-430	1000 pF
C502	012-430	1000 pF
C503	012-192	1.2 pF
C504	012-217	1000 pF
C505	012-430	1000 pF
C506	012-430	1000 pF
C508	012-430	1000 pF
C509	012-430	1000 pF
C511	012-430	1000 pF
C512	012-430	1000 pF
C513	012-430	1000 pF

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>CAPACITORS DESCRIPTION</u>
C514	012-050	.01 uF
C515	012-430	1000 pF
C516	012-283	100 pF
C517	012-430	1000 pF
C519	012-430	1000 pF
C521	012-430	1000 pF
C522	012-430	1000 pF
C523	012-430	1000 pF
C524	012-430	1000 pF
C525	012-430	1000 pF
C526	012-430	1000 pF
C527	012-219	1000 pF
C528	012-219	1000 pF
C529	012-219	1000 pF
C531	012-217	1000 pF
C536	012-091	3.3 pF
C537	012-150	120 pF
C538	012-192	1.2 pF
C539	015-034	2.7 - 20pF Variable
C541	015-034	2.7 - 20pF Variable
C600	012-268	.1 uF, 10V
C601	012-430	1000 pF
C602	012-430	1000 pF
C603	012-430	1000 pF
C604	012-430	1000 pF
C605	012-430	1000 pF
C606	012-430	1000 pF
C607	012-430	1000 pF
C608	012-430	1000 pF
C609	012-430	1000 pF
C611	012-430	1000 pF
C612	012-430	1000 pF
C613	012-217	1000 pF
C614	012-430	1000 pF
C615	012-430	1000 pF
C616	012-430	1000 pF
C617	012-217	1000 pF
C618	012-217	1000 pF
C619	015-013	.8 - 8.5pF Variable
C621	015-013	.8 - 8.5pF Variable
C623	012-430	1000 pF
C624	012-218	220 pF
C625	012-217	1000 pF
C626	012-009	1000 pF
C627	012-218	220 pF
C670	012-430	1000 pF
C801	012-217	1000 pF
C802	012-227	220 pF, 200V
C803	012-999	Factory Selected Value

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>CAPACITORS DESCRIPTION</u>
C804	015-034	2.7 - 20pF Variable
C805	012-092	5 pF
C806	012-217	1000 pF
C807	012-999	Factory Selected Value
C808	015-034	2.7 - 20pF Variable
C809	012-011	10 pF
C812	012-217	1000 pF
C813	012-999	Factory Selected Value
C814	012-227	220 pF,200V
C815	015-034	2.7 - 20pF Variable
C816	012-217	1000 pF
C818	015-034	2.7 - 20pF Variable
C819	015-034	2.7 - 20pF Variable
C821	015-034	2.7 - 20pF Variable
C822	015-034	2.7 - 20pF Variable
C825	012-050	.01 uF
C826	012-430	1000 pF
C827	012-430	1000 pF
C828	012-430	1000 pF
C829	012-132	.1 uF,100V
C830	012-430	1000 pF
C835	012-103	15 pF
C836	012-227	220 pF,200V
C837	012-217	1000 pF
C839	012-083	12 pF
C841	012-057	7 pF
C842	012-050	.01 uF
C843	012-430	1000 pF
C844	012-430	1000 pF
C845	012-430	1000 pF
C846	012-276	10 uF,35V
C851	015-034	2.7 - 20pF Variable
C852	015-034	2.7 - 20pF Variable
C853	015-034	2.7 - 20pF Variable
C854	015-034	2.7 - 20pF Variable
C855	015-034	2.7 - 20pF Variable

DIODES

CR1	025-077	W06
CR2	025-077	W06
CR101	025-086	1N4446
CR102	025-086	1N4446
CR103	025-086	1N4446
CR201	025-086	1N4446
CR202	025-086	1N4446
CR401	025-086	1N4446
CR402	025-086	1N4446
CR403	025-086	1N4446

CIRCUIT
REF. NO.

TEXSCAN
STOCK NO.

DIODES
DESCRIPTION

CR404	025-086	1N4446
CR405	025-086	1N4446
CR501	025-080	HP5082
CR601	025-070	1N100
CR602	025-070	1N100
CR603	025-002	1N82
CR604	025-002	1N82
CR605	025-080-00	HP5082-3
CR606	025-080-00	HP5082-3
CR607	025-080-00	HP5082-3
CR608	025-002	1N82

INTEGRATED CIRCUITS

IC2	076-012	741K
IC4	076-012	741K
IC5	076-050	7805
IC101	076-013	1458
IC102	076-045	741S
IC103	076-045	741S
IC201	076-002	741C
IC301	076-064	4136
IC351	076-020	4531
IC375	076-002	741C

INDUCTORS

L501	035-002	2.2 uH
L502	035-078	3.3 uH
L503	035-054-15	Factory Selected Value
L504	035-054-14	Factory Selected Value
L505	035-004	.68 uH
L506	035-004	.68 uH
L507	035-004	.68 uH
L508	035-002	2.2 uH
L509	035-127-00	Factory Selected Value
L515	035-001	1 uH
L516	035-137-06	Factory Selected Value
L601	035-004	.68 uH
L602	035-054-16	Factory Selected Value
L603	035-024	.22 uH
L604	035-045	.39 uH
L605	035-078	3.3 uH
L606	035-045	.39 uH
L607	035-137-05	Factory Selected Value
L608	035-137-05	Factory Selected Value
L609	035-001	1 uH
L611	035-045	.39 uH
L612	035-082	1 mH
L613	035-041	100 uH

CIRCUIT
REF. NO.

TEXSCAN
STOCK NO.

INDUCTORS
DESCRIPTION

L614	035-041	100 uH
L615	035-082	1 mH
L616	035-002	2.2 uH
L617	035-002	2.2 uH
L618	035-002	2.2 uH
L801	035-127-00	Factory Selected Value
L804	035-127-00	Factory Selected Value
L805	035-127-00	Factory Selected Value
L809	035-127-00	Factory Selected Value
L811	035-127-00	Factory Selected Value
L812	035-137-06	Factory Selected Value
L813	035-137-06	Factory Selected Value
L814	035-137-06	Factory Selected Value
L815	035-137-06	Factory Selected Value

TRANSISTORS

Q1	062-010	2N3638A
Q2	062-015	2N3568
Q7	062-024	2N3644
Q101	062-137	MBS4991
Q102	062-024	2N3644
Q201	062-048	40362
Q202	062-015	2N3568
Q203	062-015	2N3568
Q204	062-054	MJE4922
Q301	062-010	2N3638A
Q302	062-015	2N3568
Q351	062-025	2N4360
Q352	062-012	2N4221
Q401	062-048	40362
Q402	062-015	2N3568
Q403	062-075	MJE1090
Q404	062-076	MJE1100
Q405	062-024	2N3644
Q406	062-024	2N3644
Q407	062-075	MJE1090
Q501	062-035	2N5109
Q502	062-078	2SC1251
Q503	062-078	2SC1251
Q601	062-035	2N5109
Q602	062-088	2N5179
Q801	062-142	SD1300
Q802	062-142	SD1300
Q803	062-142	SD1300
Q804	062-141	SD1232
Q805	062-078	2SC1251

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>RESISTORS DESCRIPTION</u>
R1	047-478	7.5 ohm, 3W
R2	045-626	10 ohm, $\frac{1}{4}$ W
R3	045-717	1.5Kohm, $\frac{1}{4}$ W
R4	045-724	2.2Kohm, $\frac{1}{4}$ W
R5	048-252	25Kohm Variable
R7	046-002	2.7 ohm, $\frac{1}{2}$ W
R8	045-752	10Kohm, $\frac{1}{4}$ W
R14	047-478	7.5 ohm, 3W
R15	045-626	10 ohm, $\frac{1}{4}$ W
R16	045-710	1Kohm, $\frac{1}{4}$ W
R17	047-440	22.1Kohm, $\frac{1}{4}$ W
R18	047-440	22.1Kohm, $\frac{1}{4}$ W
R19	046-002	2.7 ohm, $\frac{1}{2}$ W
R21	045-752	10Kohm, $\frac{1}{4}$ W
R101	045-745	6.8Kohm, $\frac{1}{4}$ W
R102	045-742	5.6Kohm, $\frac{1}{4}$ W
R103	045-742	5.6Kohm, $\frac{1}{4}$ W
R104	045-742	5.6Kohm, $\frac{1}{4}$ W
R105	045-999	Factory Selected Value
R106	045-808	220Kohm, $\frac{1}{4}$ W
R107	045-710	1Kohm, $\frac{1}{4}$ W
R108	045-742	5.6Kohm, $\frac{1}{4}$ W
R109	045-749	8.2Kohm, $\frac{1}{4}$ W
R110	045-794	100Kohm, $\frac{1}{4}$ W
R111	045-724	2.2Kohm, $\frac{1}{4}$ W
R112	045-735	3.9Kohm, $\frac{1}{4}$ W
R113	048-239	20Kohm Variable
R114	048-276	5K/5Mohm Variable
R115	045-721	1.8Kohm, $\frac{1}{4}$ W
R116	045-815	330Kohm, $\frac{1}{4}$ W
R117	045-724	2.2Kohm, $\frac{1}{4}$ W
R118	045-710	1Kohm, $\frac{1}{4}$ W
R119	045-688	330 ohm, $\frac{1}{4}$ W
R121	045-705	750 ohm, $\frac{1}{4}$ W
R122	045-705	750 ohm, $\frac{1}{4}$ W
R123	048-264	10K/2PIT Variable
R124	045-999	Factory Selected Value
R125	045-999	Factory Selected Value
R126	045-999	Factory Selected Value
R127	045-801	150Kohm, $\frac{1}{4}$ W
R128	045-801	150Kohm, $\frac{1}{4}$ W
R129	045-759	15Kohm, $\frac{1}{4}$ W
R131	045-759	15Kohm, $\frac{1}{4}$ W
R132	045-759	15Kohm, $\frac{1}{4}$ W
R133	047-440	10Kohm, $\frac{1}{4}$ W
R134	045-999	Factory Selected Value
R135	047-462	1Kohm, $\frac{1}{4}$ W
R138	048-137	10Kohm Variable
R139	048-137	10Kohm Variable
R141	048-264	10K/2PIT Variable

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>RESISTORS DESCRIPTION</u>
R142	045-999	Factory Selected Value
R143	045-999	Factory Selected Value
R144	047-440	10Kohm, $\frac{1}{4}W$
R145	045-999	Factory Selected Value
R146	045-999	Factory Selected Value
R147	047-462	1Kohm, $\frac{1}{4}W$
R201	045-780	47Kohm, $\frac{1}{4}W$
R202	048-208	1Kohm Variable
R203	045-784	56Kohm, $\frac{1}{4}W$
R204	045-780	47Kohm, $\frac{1}{4}W$
R205	048-208	1Kohm Variable
R206	045-724	2.2Kohm, $\frac{1}{4}W$
R207	045-710	1Kohm, $\frac{1}{4}W$
R208	047-460	100Kohm, $\frac{1}{2}W$
R209	045-784	56Kohm, $\frac{1}{4}W$
R210	047-461	11.2Kohm, $\frac{1}{4}W$
R211	045-784	56Kohm, $\frac{1}{4}W$
R212	045-742	5.6Kohm, $\frac{1}{4}W$
R214	045-731	4.7Kohm, $\frac{1}{4}W$
R215	048-196	2Kohm Variable
R216	045-682	220 ohm, $\frac{1}{4}W$
R217	048-193	10Kohm Variable
R218	045-773	33Kohm, $\frac{1}{4}W$
R219	048-196	2Kohm Variable
R221	045-668	100 ohm, $\frac{1}{4}W$
R222	046-372	120 ohm, 1W
R223	045-780	47Kohm, $\frac{1}{4}W$
R224	045-784	56Kohm, $\frac{1}{4}W$
R225	045-731	3.3Kohm, $\frac{1}{4}W$
R226	046-114	1.2Kohm, $\frac{1}{2}W$
R301	048-062	100Kohm Variable
R302	048-198	100Kohm Variable
R303	048-198	100Kohm Variable
R304	048-198	100Kohm Variable
R305	048-198	100Kohm Variable
R306	048-198	100Kohm Variable
R307	048-198	100Kohm Variable
R308	048-198	100Kohm Variable
R309	045-529	680Kohm, 1/8W
R310	045-326	10 ohm, 1/8W
R311	045-410	1Kohm, 1/8W
R313	045-512	270Kohm, 1/8W
R314	045-526	560Kohm, 1/8W
R315	045-424	2.2Kohm, 1/8W
R316	045-417	1.5Kohm, 1/8W
R318	045-452	10Kohm, 1/8W
R319	045-494	100Kohm, 1/8W
R320	048-246	1Mohm Variable
R321	045-494	100Kohm, 1/8W
R322	045-452	10Kohm, 1/8W
R323	045-400	560 ohm, 1/8W

<u>CIRCUIT</u> <u>REF. NO.</u>	<u>TEXSCAN</u> <u>STOCK NO.</u>	<u>RESISTORS</u> <u>DESCRIPTION</u>
R324	045-400	560 ohm, 1/8W
R325	048-199	10Kohm Variable
R326	048-210	10Kohm Variable
R327	045-452	10Kohm, 1/8W
R328	045-452	10Kohm, 1/8W
R329	045-452	10Kohm, 1/8W
R331	048-199	10Kohm Variable
R332	045-452	10Kohm, 1/8W
R333	045-442	5.6Kohm, 1/8W
R334	045-452	10Kohm, 1/8W
R335	045-431	3.3Kohm, 1/8W
R351	047-460	100Kohm, 1/2W
R352	047-460	100Kohm, 1/2W
R353	047-460	100Kohm, 1/2W
R354	047-460	100Kohm, 1/2W
R355	048-157	10Kohm Variable
R356	045-382	220 ohm, 1/8W
R357	045-424	2.2Kohm, 1/8W
R358	045-836	1Mohm, 1/4W
R359	045-826	560Kohm, 1/4W
R360	045-654	47 ohm, 1/4W
R361	045-826	560Kohm, 1/4W
R362	045-742	5.6Kohm, 1/4W
R363	045-836	1Mohm, 1/4W
R375	048-173	200 ohm Variable
R376	045-452	10Kohm, 1/8W
R377	045-442	5.6Kohm, 1/8W
R378	045-508	220Kohm, 1/8W
R379	045-494	100Kohm, 1/8W
R401	045-752	10Kohm, 1/4W
R402	045-773	33Kohm, 1/4W
R403	045-742	5.6Kohm, 1/4W
R404	045-745	6.8Kohm, 1/4W
R405	045-745	6.8Kohm, 1/4W
R406	045-710	1Kohm, 1/4W
R407	045-656	51 ohm, 1/4W
R408	045-717	1.5Kohm, 1/4W
R409	045-773	33Kohm, 1/4W
R411	045-773	33Kohm, 1/4W
R412	045-773	33Kohm, 1/4W
R413	045-752	10Kohm, 1/4W
R414	045-752	10Kohm, 1/4W
R415	045-731	3.3Kohm, 1/4W
R501	047-184	100 ohm, 1/4W
R502	047-476	4.75Kohm, 1/4W
R503	047-357	1.439Kohm, 1/4W
R504	047-462	1Kohm, 1/4W
R506	045-326	10 ohm, 1/8W
R508	045-326	10 ohm, 1/8W
R509	045-326	10 ohm, 1/8W

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>RESISTORS DESCRIPTION</u>
R511	045-442	5.6Kohm, 1/8W
R512	045-424	2.2Kohm, 1/8W
R513	046-082	220 ohm, 1/2W
R514	047-549	180 ohm, 1/2W
R515	045-626	10 ohm, 1/2W
R516	045-389	330 ohm, 1/8W
R517	045-354	47 ohm, 1/8W
R518	045-438	4.7Kohm, 1/8W
R519	045-438	4.7Kohm, 1/8W
R521	045-626	10 ohm, 1/2W
R522	045-626	10 ohm, 1/2W
R523	045-424	2.2Kohm, 1/8W
R524	045-424	2.2Kohm, 1/8W
R525	045-340	22 ohm, 1/8W
R526	045-340	22 ohm, 1/8W
R527	045-340	22 ohm, 1/8W
R601	047-076	154 ohm, 1W
R602	047-462	1Kohm, 1/2W
R603	047-257	1.439Kohm, 1/2W
R604	047-257	1.439Kohm, 1/2W
R605	045-340	22 ohm, 1/8W
R606	045-393	390 ohm, 1/8W
R607	045-442	5.6Kohm, 1/8W
R608	045-414	1.2Kohm, 1/8W
R609	045-340	22 ohm, 1/8W
R611	045-354	47 ohm, 1/8W
R612	045-626	10 ohm, 1/2W
R614	047-019	116.1 ohm, 1/2W
R615	047-203	40.2Kohm, 1W
R616	047-516	2741 ohm, 1W
R617	045-326	10 ohm, 1/8W
R623	045-389	330 ohm, 1/8W
R624	045-382	220 ohm, 1/8W
R625	045-372	120 ohm, 1/8W
R626	045-452	10Kohm, 1/8W
R627	045-389	330 ohm, 1/8W
R628	045-382	220 ohm, 1/8W
R629	045-612	4.7 ohm, 1/4W
R630	045-612	4.7 ohm, 1/4W
R631	045-340	22 ohm, 1/8W
R632	045-340	22 ohm, 1/8W
R633	047-009	49.9 ohm, 1/2W
R634	045-414	1.2Kohm, 1/8W
R635	045-357	56 ohm, 1/8W
R636	045-357	56 ohm, 1/8W
R637	045-382	220 ohm, 1/8W
R638	045-452	10Kohm, 1/8W
R639	045-640	22 ohm, 1/2W
R640	045-326	10 ohm, 1/8W
R641	045-372	120 ohm, 1/8W

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>RESISTORS DESCRIPTION</u>
R642	045-382	220 ohm, 1/8W
R643	045-396	470 ohm, 1/8W
R801	045-438	4.7Kohm, 1/8W
R802	045-438	4.7Kohm, 1/8W
R803	045-375	150 ohm, 1/8W
R804	045-654	47 ohm, $\frac{1}{4}$ W
R805	045-326	10 ohm, 1/8W
R806	048-196	2Kohm Variable
R807	045-326	10 ohm, 1/8W
R808	045-382	220 ohm, 1/8W
R811	045-326	10 ohm, 1/8W
R812	048-196	2Kohm Variable
R813	045-654	47 ohm, $\frac{1}{4}$ W
R814	045-333	15 ohm, 1/8W
R816	045-431	3.3Kohm, 1/8W
R817	045-396	470 ohm, 1/8W
R818	045-326	10 ohm, 1/8W
R819	045-654	47 ohm, $\frac{1}{4}$ W
R821	045-326	10 ohm, 1/8W
R822	045-649	36 ohm, $\frac{1}{4}$ W
R823	045-640	22Kohm, 1/8W
R824	045-428	2.7 ohm, 1/8W
R825	045-312	4.7 ohm, 1/8W
R827	046-054	47 ohm, $\frac{1}{2}$ W
R828	045-312	4.7 ohm, 1/8W
R829	046-054	47 ohm, $\frac{1}{2}$ W
R832	046-368	100 ohm, 1W
R842	045-339	22 ohm, 1/8W
R843	045-339	22 ohm, 1/8W
R844	045-428	2.7 ohm, 1/8W
R845	045-339	22 ohm, 1/8W
R846	045-654	47 ohm, $\frac{1}{4}$ W
R847	045-438	4.7Kohm, 1/8W
R848	045-326	10 ohm, 1/8W
R849	045-382	560 ohm, 1/8W
R850	045-339	22 ohm, 1/8W
R851	045-339	22 ohm, 1/8W
R852	048-196	2Kohm Variable
R853	048-196	2Kohm Variable
R854*	045-312	4.7 ohm, 1/8W
R855	045-354	47 ohm, 1/8W
R856	045-626	10 ohm, $\frac{1}{4}$ W
R857	045-626	10 ohm, $\frac{1}{4}$ W
R858	045-339	22 ohm, 1/8W
R859	045-326	10 ohm, 1/8W

<u>CIRCUIT REF. NO.</u>	<u>TEXSCAN STOCK NO.</u>	<u>SWITCHES DESCRIPTION</u>
S1	057-147	2T3P
S102	057-200-00	4P5T
S103	057-186	2P2T
S104	057-155	1P1T
S105	057-202	2P2T
S201	057-199	1P2T
S301	057-185	2P2T
S302	057-185	2P2T
S303	057-185	2P2T
S304	057-185	2P2T
S305	057-185	2P2T
S306	057-185	2P2T
S307	057-185	2P2T
S308	057-201	2P3T
S309	057-201	2P3T
S351	057-201	2P3T
S401	057-200-01	4P4T
S901	057-185	2P2T

SPECIAL PURPOSE DIODES

VR1	025-010	10V Zener
VR101	025-033	6.8V Zener
VR201	025-038	15V Zener
VR551	064-022	KSW2101
VR552	064-025	1N3140
VR553	064-025	1N3140
VR554	064-025	1N3140
VR555	064-025	1N3140
VR556	064-025	1N3140
VR557	064-025	1N3140
VR601	064-025	1N3140
VR602	064-025	1N3140
VR603	064-025	1N3140

CONDICTIONS OF SALE

Determination of prices, terms, conditions of sale, and final acceptance of orders are made only at our plant in Indianapolis, Indiana.

All prices are F.O.B. Indianapolis, Indiana, USA.

Terms in the United States and Canada are Net 30 days if credit has been arranged.

Terms throughout the rest of the free world are arranged with Texscan's area representative.

SERVICE AND PARTS

Repair service is available at our plant in Indianapolis, Indiana. Before returning an instrument for repair, please write to us, requesting a Returned Material Authorization. On receipt of shipping authorization, forward the instrument prepaid. Care should be taken in packing the instrument to insure protection in transit. Also, state the type and serial number of the instrument, date of purchase, and details concerning the difficulty.

Repair parts may be ordered from our home plant or through our sales representatives. When ordering repair parts, please specify the part number and description of the item, and the type and serial number of the instrument in which it is used.

TEXSCAN RECOMMENDS FACTORY REPAIR OF RF CIRCUITS

If failure occurs in an RF section of any TEXSCAN test instrument, TEXSCAN recommends that the complete instrument be returned to the factory for repair and calibration. Replacement of an RF assembly or component may result in failure of the instrument to meet its published specifications and failure to perform within its design capabilities. TEXSCAN Customer Service personnel are experienced in the repair and calibration of the complete line of TEXSCAN test instruments. When practical, updated improvements can be included in the repaired instrument.

SPECIFICATION CHANGES

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold.

WARRANTY

Products manufactured by Jerrold-Texscan Corporation are warranted against defective materials and workmanship for one year from date of shipment. Any instrument or component which has been found to be defective during this one-year period will be repaired or replaced without charge except for vacuum tubes or batteries which have given normal service. No other warranty is expressed or implied.

SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order, we shall use our own judgment as to the best method of shipment. Unless otherwise specified, normal shipments will be by air freight or air express. Small items are sent via parcel post. The listed price for our products include the packing, but does not include the cost of shipping.

TEXSCAN RECOMMENDS FACTORY REPAIR OF RF CIRCUITS

If failure occurs in an RF section of any Jerrold-Texscan test instrument, Jerrold-Texscan recommends that the complete instrument be returned to the factory for repair and calibration. Replacement of an RF assembly or component may result in failure of the instrument to meet its published specifications and failure to perform within its design capabilities. Jerrold-Texscan Customer Repair personnel are experienced in the repair and calibration of the complete line of Jerrold-Texscan test instruments. When practical, updated improvements can be included in the repaired instrument.

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The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold.

IMPORTANT!

WARRANTY AND SERVICE INFORMATION

Products manufactured by JERROLD-TEXSCAN CORPORATION are warranted, to the original purchaser, against defective material and workmanship for a period of one year from the original date of shipment from our plant. This warranty is limited to the replacement or repair of components or parts found defective within this one-year period, including the labor involved in their replacement when the product is returned, shipping charges prepaid, to our factory in Indianapolis, Indiana. It does not apply to normal service items, such as batteries, tubes or appearance items which have given normal service, nor does it apply to damage caused by abuse, misuse, mishandling, or damage caused by shipment, unauthorized modification, repair or attempted repair. In fulfilling this warranty, JERROLD-TEXSCAN'S liability is limited to the repair of this product. The company assumes no liability for any consequential damage.

In the event that you experience difficulty with this unit, please write your local representative or Customer Repair Dept., TEXSCAN CORP., 2446 N. Shadeland Avenue, Indianapolis, Indiana 46219, or call (317) 357-8781. If return of this unit to JERROLD-TEXSCAN is authorized, you will be given a Repair Authorization number, which must be marked on the outside of the shipping container. Enclose the additional information requested below and forward the unit, shipping charges prepaid, to JERROLD-TEXSCAN. All service work is FOB our plant in Indianapolis, Indiana.

Service is also available, at nominal cost, for older JERROLD-TEXSCAN products. Please follow the same procedure described in the preceding paragraph, even though you are requesting non-warranty repairs. Not only will you help expedite the unit to Customer Repair, but you will also have established your priority.

All units handled by our Customer Repair Dept. are carefully re-inspected by our Quality Assurance Dept. to ensure that they function in accordance with the specifications which were applicable at the time of their manufacture. We reserve the right to make product improvements and changes, without incurring any liability to modify equipment previously sold. However, we do occasionally find it more expedient to update portions of older models rather than attempt repairs.

Should you desire to perform repairs in your own facility, approved replacement parts may be purchased through our Customer Repair Dept. Please order by TEXSCAN part number and specify the model and serial number of the instrument in which it is to be used.

REPAIR AUTHORIZATION NO. _____ DATE _____ YOUR P.O.NO. _____
TYPE OF EQUIPMENT _____ MODEL _____
SERIAL NUMBER _____ DATE OF PURCHASE _____
OWNER'S NAME & ADDRESS _____
FOR FURTHER INFORMATION CONTACT _____
DESCRIPTION OF PROBLEM _____

